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PROCEEDINGS AND TRANSACTIONS

OF THE

Nova Scotian Institute of Natural Science,

OF

APR 16 1974

HALIFAX, NOVA SCOTIA.

VOL. VI. 1883-4. PART II.

CONTENTS.

PROCEEDINGS 89
LIST OF MEMBERS 91

TRANSACTIONS:—

ART. I.—Notes on the Debert Coal Field, Colchester, N. S. By EDWIN GILPIN, Jr., A.M., *Inspector of Mines*. 93
II.—Notes on the Maganese Ores of Loch Lomond. By EDWIN GILPIN, Jr., A.M., *Inspector of Mines*. 97
III.—Notes on Peculiar Auroræ. By Prof. J. G. MCGREGOR, D.Sc. 100
IV.—On the Northern Limit of Wild Grape Vines. By Prof. GEORGE LAWSON, Ph.D., L.L.D. 101
V.—Sable Island (continued.) By S. D. MCDONALD, F.G.S. 110
VI.—Glacial Action, at Rimouski, Canada, and Loch Eck, Argyleshire, Scotland. By Rev. D. HONEYMAN, D.C.L. 119
VII.—Notes of a Polariscopic and Microscopic Examination of Crystalline Rocks of Nova Scotia and Cape Breton. By. Rev. D. HONEYMAN, D.C.L. 121
VIII.—Some Physical Features of Nova Scotia with notes on Glacial Action. By M. MURPHY, C.E., *Prov. Gov. Engineer*. 130
IX.—Notes on Nova Scotia Fresh-water Sponges. By A. H. MCKAY, B.A., B.Sc. ....

APPENDIX:—

Report of WM. GOSSIP, ESQ., *Delegate to the Royal Society of Canada, May*, 1883. 1
Glacial Distribution in Canada. By Rev. D. HONEYMAN, D.C.L. *Reprinted from Proceedings of the Geologists' Association, London*. ....

HALIFAX, NOVA SCOTIA—WILLIAM GOSSIP, 103 GRANVILLE ST.

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Dep. Speaker of House of Commons

PROCEEDINGS

OF THE

Nova Scotian Institute of Natural Science.

VOL. VI. PART II.

Provincial Museum, October 26, 1883.

ANNIVERSARY MEETING.

ROBERT MORROW, F. R. M. S., *President, in the Chair.*

INTER ALIA.

The following gentlemen were elected office-bearers for the ensuing year.

President,—ROBERT MORROW, F. R. M. S.

Vice Presidents,—JOHN SOMERS, M. D., WILLIAM GOSSIP, ESQ.

Secretaries,—REV. D. HONEYMAN, D. C. L,, F. R. S. C., &c.
ALEXR. MCKAY, Supervisor Public Schools.

Treasurer,—W. C. SILVER, ESQ.

Council,—WM. H. HARRINGTON, AUGUSTUS ALLISON, SIMON D. MACDONALD, F. G. S., MARTIN MURPHY, C. E.. JAMES R. DEWOLF, M. D., EDWIN GILPIN, F. R. S. C.. &c., J. G. MACGREGOR, D. Sc., F. R. S. C., &c., GEORGE LAWSON, Ph. D., LL. D., F. R. S. C., &c.

ORDINARY MEETING, Nov. 12, 1883.

DR. SOMERS, Vice President, *in the Chair.*

A Paper was read by WM. GOSSIP, Esq., delegate to the Royal Society of Canada, giving an account of his visit to Canada, and of proceedings of the R. S. C.

A Paper by EDWIN GILPIN, F. G. S., Inspector of Mines, "On the De Bert Coal Fields," was read by the Secretary.

ORDINARY MEETING, Dec. 12, 1883.

DR. SOMERS, Vice President, *in the Chair.*

DR. HONEYMAN, by request, read a Paper entitled "Natural History of the Canadian Department of the Great International Fisheries Exhibition, London, 1883."

ORDINARY MEETING, Jan. 1884.

DR. SOMERS, Vice President, *in the Chair.*

A Paper was read by EDWIN GILPIN, F. R. S. C., &c., "On Manganese Ores of Cape Breton."

J. G. MACGREGOR, D. Sc., read a Paper "On two Special Auroræ."

A Paper was also read by GEORGE LAWSON, Ph. D., LL. D., F. R. S., &c., "On the Northern Limits of Indigenous Grape Vines."

ORDINARY MEETING, Feb. 11, 1884.

J. J. FOX, Esq., *in the Chair.*

A Paper was read by SIMON D. MACDONALD "On Sable Island—its changed position," &c.

ORDINARY MEETING, March 10, 1884.

MARTIN MURPHY, C. E., Vice President, *in the Chair.*

DR. HONEYMAN read 2 Papers:

1. "On Glacial Action at Rimouski, Canada, and Loch Ech, Argyleshire, Scotland.

2, "Notes on Polariscopic and Microscopic examinations of Crystalline Rocks of Nova Scotia and Cape Breton."

ORDINARY MEETING, April 14, 1884.

WM. GOSSIP, Esq., Vice President, *in the Chair.*

M. MURPHY, C. E., was elected a delegate to the Royal Society of Canada.

A Paper was read by M. MURPHY, C. E., "On some Physical Features of Nova Scotia, with Notes on Glacial Action."

ORDINARY MEETING, May 12, 1884.

DR. SOMERS, Vice President, *in the Chair.*

A paper, "Notes on Our Fresh Water Sponges," by A. H. McKay, B. A., B. Sc., Principal of Pictou Academy, was read by the Secretary, Alexander McKay, Esq.

LIST OF MEMBERS.

Date of Admission.

1873. Jan. 11—Akins, T. B., D. C. L., Halifax.
69. Feb. 3—Allison, Augustus, *Meteorologist*, Halifax.
77. Dec. 19—Bayne, Herbert E. PH. D., F. R. S. C., *Professor of Chemistry, &c.*, Royal Military College, Kingston, Ont.
84. Mar. 13—Bowman, Maynard, *Public Analyst*, Halifax.
64. Dec. —Brown, C. E., Halifax.
63. Oct. 26—DeWolfe, James R., M. D., L. R. C. S. E.
82. May 8—Fox, John J., Halifax.
78. Jan. 30—Geldert, J. M., *Barrister*, Halifax.
73. Apl. 11—Gilpin, Edwin, F. G. S., F. R. S. C., *Government Inspector of Mines.*
63. Jan. 5—Gilpin, J. Bernard, M. D., M. R. C. S., F. R. S. C.
63. Feb. 5—Gossip, Wm. *Vice-President*, Halifax.
63. Feb. 5—Downs, Andrew, M. Z. S., *Taxidermist*, Halifax.
83. Mar. 12—Forbes, John, *Starr Manufacturing Co.*, Dartmouth.
63. Mar. 12—Foster, James G., *Barrister*, Dartmouth.
81. Dec. 12—Hare, Alfred, Bedford.
82. Apl. 10—Harrington, D., M. D.. Halifax.
67. Dec. 3—Honeyman, Rev. Dr., D. C. L., F. R. S. C., F. A. S., &c., *Secretary, Curator Provincial Museum*, Halifax.
74. Dec. 10—Jack, Peter, *Cashier of People's Bank*, Halifax.
63. Jan. 5—Jones, J. M., F. R. S. C., F. L. S., Berwick, N. S.
82. Apl. 10—Keating, E. H., C. E., *City Engineer*, Halifax.
64. Mar. 7—Lawson, G., PH. D., LL. D., F. R. S. C., F. C. I., *Professor of Chemistry and Mineralogy, Dalhousie College*, Halifax.
81. Mar 14—Macdonald, Simon D., F. G. S.
77. Jan. 13—MacGregor, J. G., D. SC., F. R. S. E., F. R. S. C., *Professor of Physics, Dalhousie College*, Halifax.
72. Feb. 5—McKay, Alex., *Secretary, Supervisor of Halifax Public Schools.*
78. Nov. 1—McLeod, John, Demerara, West Indies.
77. Jan. 13—Morrow, Geoffrey, Halifax.
72. Feb. 10—Morrow, Robert, F. R. M. S., *President*, Halifax.
70. Jan. 10—Murphy, Martin, C. E., *Provincial Engineer*, Halifax.
79. Dec. 14—Neal, W. H., Halifax.
65. Aug. 19—Nova Scotia, the Right Rev. Hibbert Binney, *Lord Bishop of*
79. Nov. 11—Poole, H. S., ASSOC. R. S. M., F. G. S., *Supt. Acadia Mines*, Pictou.
76. Jan. 20—Power, Hon. L. G., *Senator*, Halifax.
71. Nov. 19—Reid, A. P., M. D., *Superintendent of Provincial Lunatic Asylum*, Dartmouth.
65. Jan. 8—Rutherford, Jno., *Superintendent of Albion Mines*, Pictou.

64. May 7—Silver, W. C., *Treasurer*, Halifax.
75. Jan. 11—Somers, John, M. D., *Professor of Physiology and Zoology, Halifax Medical College.*

ASSOCIATE MEMBERS.

82. Oct. 1—Gunn, John G., *Inspector of Schools*, Cape Breton.
81. Nov. 13—Harris, C., *Professor of Civil Engineering, Royal Military College*, Kingston, Ont.
76. Nov. 9—Kennedy, Prof., *King's College*, Windsor, N. S.
71. Jan. 11—McKay, H. A., B. A., B. C., *Principal of Pictou Academy.*
82. Mar. 31—McKenzie, W. B., *Engineer*, Moncton, New Brunswick.
83. Mar. 12—McKenzie, O. H., M. D., *Inspector of Schools*, Parrsboro.
78. Mar. 12—Patterson, Rev. G., D. D., New Glasgow.
84. Apl. 4—Pineo, A. J., *Editor of Canadian Science Monthly*, Wolfville, N. S.

CORRESPONDING MEMBERS.

71. Nov. 29—Ball, Rev. E., Tangier.
71, Oct. 12—Marcou, Jules, Cambridge, Mass.
80. June 10—McClintock, Sir Leopold, Knt., F. R. S., *Vice Admiral.*
77. May 12—Weston, Thomas C., *Geological Survey of Canada.*

LIFE MEMBER.

Parker, Hon. Dr., M. L. C., Nova Scotia.

TRANSACTIONS
OF THE
Nova Scotian Institute of Natural Science.

ART. I.—NOTES ON THE DEBERT COAL FIELD, COLCHESTER CO., N. S. BY EDWIN GILPIN, JR., A. M., F. G. S., F. R. S. C., *Inspector of Mines.*

(Read 12th Nov., 1883.)

DURING the past few months a good deal of interest has been shown in Mining circles over the reported discoveries of coal seams, of workable size, on the DeBert River, Colchester Co. In this conclusion the following notes of a brief visit to the ground may prove interesting to the members of the Institute, and I only regret that the attention necessarily directed to mines in operation has prevented me from giving more time to the problems presented by this practically unknown district.

The presence of coal beds on the DeBert and Chiganoise Rivers has long been known to the geologist. Gesner, one of the pioneers of Nova Scotian Geology, writing in 1836, described the signs of coal at various points along the north side of the Basin of Minas, from Cape Chignecto to Truro, and remarks, page 129 of his "Geology and Mineralogy of Nova Scotia," that "About five miles northward of the Lower DeBert bridge the coal measures of the mountains rise above the gypseous and saliferous sandstones, and a beautiful section of their strata is made by the river passing over them. Two small veins of coal have been intersected, although it is not known what quantity of that valuable substance is still hidden in the adjacent rocks."

Dr. Dawson, in the second edition of his Acadian Geology, page 264, speaks of the metamorphic slates of the Cobequid Mountains being succeeded by conglomerates, and then by "coal measure rocks, consisting of gray sandstones and dark shales,

and a few thin seams of coal, and abundance of leaves of cordaites, and a few calamites and stigmaria."

He further remarks: "We can trace this coal measure back from Advocate Harbour, near Cape Chignecto, to the upper part of the Salmon River of Truro, where it adjoins the carboniferous district of Pictou. It is (generally speaking) much broken and disturbed; and although it widens considerably towards its eastern extremity, it nowhere attains a great development, either in horizontal extent, or in the magnitude of its coal seams." From Advocate Harbour to Partridge Island the belt contains contorted shales and sandstones yielding a few fossil plants, scales of fishes, and shells of Naiadites. Mr. Matthew Jones, a member of this Institute, some years ago found in these strata footprints of a large reptilian animal, referable to the genus sauropus. Similar shales and sandstones outcrop on the banks of the various rivers falling into the Basin of Minas, and show beds of bituminous limestone, with cyprids and fish scales, fireclays, clay ironstones, etc., and yield characteristic fossil plants of several of the species found in the Joggins section.

In the same work Dr. Dawson has discussed the physical conditions which governed the deposition of the coal and associated carboniferous measures of the district. The evidence of the foldings of the carboniferous of the north side of the Basin of Minas, plainly given by the various river sections, leads to the anticipation that the coal measure band may prove disturbed. The longitudinal foldings are useful to the prospector, as they bring the various coal crops to the surface, and define the limits within which his researches can be carried on with profit. The transverse folding and faults caused by unequal strains, and by the irregularity of the great mountain chain, the determining element, may prove a source of expense to the miner engaged in economic development.

The upper DeBert bridge, on the Londonderry road, appears to be a little to the south of the centre of the Basin in this locality. Following the stream downwards from the bridge the coal beds appear about in the relative order of the section, which is descending geologically speaking:—

	Ft.	*In.*
Strata	200	9
Coal seam	2	6
Strata	120	0
? Coal seam (so-called "nine feet")	9	0
Strata	30	0
Coal seam	2	0
Strata	140	0
Coal seam	6	0
Strata	100	0
Conglomerate, base of section.		
Total	609	6

The first seam met is one on the west side of the River, and it is stated to measure about 2 ft. 6 in. of coal. The nine feet seam, so-called, had not been opened at the time of my visit, and the thickness is that given by the man in charge of the boring. The seam below this is exposed on the west bank of the river, nearly on the line of the seam just referred to as being nine feet thick.

The six feet seam was opened last winter by a short slope, and about 50 tons of coal were extracted. It is stated to have in the centre a band of shaley coal about 9 inches thick. I was unable to verify the dimensions by actual measurement, as all the openings were full of water at the time of my visit, but the outcrop of the bed under the waters of the river apparently confirmed them.

The coal looked unusually well for a crop exposure, and samples selected to form an average gave the following results:—

Coal compact. Cleavage planes very obliquely inclined to each other. Fractures of the coal presented a conchoidal and lustrous appearance. The deposition planes showed a good deal of mineral charcoal. The coal is laminated with numerous bright pitchy layers up to one-half of an inch in thickness. A few films of calc-spar showed in the cleavage planes, and there was very little visible pyrites. Powder dark reddish brown.

ON ANALYSIS *(by fast coking.)*

Hygroscopic moisture	1·594
Volatile combustible matter	33·188
Fixed carbon	58·206
Ash	7·012
	100·000
Sulphur	2·648

Coke fairly coherent.

From this analysis it will appear that the coal, although holding more sulphur than is usually found in the coals of Nova Scotia proper, is of good quality, and similar in general composition to that mined at Spring Hill.

About 100 feet below the 6 feet seam is a bed of conglomerate, having a dip to the north similar to that of the section given above. The conglomerate appeared to be about 150 feet wide on the river, and to grow broader to the westward. Where exposed on a small brook about ½ of a mile west of the river, it presented a double dip S 5° W and N 10° W, apparently forming the saddle of an anticlinal, and was overlaid to the south by gray shaley sandstones dipping S 5° W and at an angle of 25°.

On the north side of the conglomerate, on the brook, at about the same distance from it as the so-called nine foot seam is on the river, an imperfect exposure of coal is met presenting the following section:—

	Ft.	*In.*
Coal, with shaley bands	2	0
Fireclay	2	2
Coal, good	0	10
Total	5	0

About 100 feet further up the brook a four feet seam of coal is said to have been proved by a bore hole.

About 100 yards above the bridge is an exposure of measures holding a seam of coal about 18 inches thick, and running nearly at right angles to the course of the seams already described. From this it would appear that the beds exposed on the river are

at the eastern apex of a subordinate basin formed by transverse folding.

Should further research show that at this point the seams referred to maintain their size, and extend in a form permitting of economic exploitation, the discoveries are of great importance. The search for similar seams may then reasonably be made at other points along the coal band, and certainly the areas of the Minas Basin coal field is large enough to allow a hope that in the future it may be added to the list of our productive districts.

ART. II.—NOTES ON THE MANGANESE ORES OF LOCH LOMOND, C. B.

BY EDWIN GILPIN, A. M., F. G. S., F. R. S. C., *Inspector of Mines.*

(Read 14th Jan., 1884.)

FOR a number of years the presence of these ores in Cape Breton was recorded only by the mineralogist. Recently, however, deposits of economic value have been found and worked. The ores of manganese occur, in Nova Scotia proper, in strata of Lower Carboniferous age, occupying a horizon low down in the Marine Limestone formation. The late Dr. How, in a paper read before this Institute some years ago, gave an interesting account of these minerals as they occur and are worked in Hants County. This evening I purpose merely to draw the attention of the Institute to their occurrence in Cape Breton, an interesting fact, as the knowledge of their presence in workable amounts in the Loch Lomond district will lead to a search for them in other parts of the Island. In all probability, the wide extent of the Cape Breton Limestones will before long afford several localities containing deposits worthy of the miner's attention. My notes are from a visit to the mine, and from information kindly furnished me by Mr. Fletcher, of the Geological Survey of Canada, who made a detailed survey of this district summer before last. The geological features of this part of Cape Breton are represented by a band of millstone grit extending from Mira River,

up the Salmon River, to Loch Lomond; and bounded on the north by the felsites of East Bay, and on the south by the felsites of the Mira Hills. At several points the Lower Carboniferous marine limestone formation crops out beneath the millstone grit, and occurs as isolated patches resting directly on the felsites, and there are patches of the basal carboniferous conglomerates brought up by faults through the millstone grit.

The locality in which these deposits have been discovered is on the Salmon River Road, about two miles east of Loch Lomond, near the line dividing Cape Breton and Richmond Counties.

The felsites formed a shore along which we now find limestones, conglomerates, shales and grits exposed as they were accumulated under the varying conditions of current, depth of water, and of the prevailing winds of the period under consideration. At some points the limestones rest on the felsites, at other points conglomerates and shales intervene. The discoveries of manganese ores, more particularly the subject of my paper, were made in one of these bays, where the felsites are succeeded by shales, grits, conglomerates, and finally by limestones, the latter extending apparently from point to point of the ancient Bay.

The manganese ores are found at the Western, or McCuish Mine, in irregular bedded layers in a soft arenaceous shale, which is in places calcareous, and coated with manganese oxide The layers vary in thickness up to 18 inches, and are sometimes connected by vertical stringers of ore. The shales when weathered present nodules of ore, and large quantities are present as films on the cleavage planes of the shale.

At the Eastern, or Morrison mine, the ore at the time of my visit was mined from a bed underlying a thin layer of black manganiferous limestone, with red and greenish shales and sandstones and conglomerate. The thickness of the ore and of the limestone varied from 2 to 8 inches. The average thickness of the two layers being 8 inches.

The ore was found at several other points in the vicinity as lenticular masses and irregular nests in conglomerate, etc., and

sometimes forming the cementing material. This latter mode of occurrence is similar to that shown by the red hematites found in the lower carboniferous conglomerates at several parts of the island near their junction with older strata. And near the Loch Lomond post office a highly manganiferous red hematite occurs under conditions apparently of a similar nature.

The limestone overlying these measures is highly manganiferous and ferriferous, and contains numerous crystals of galena, which some time ago incited prospecting, as they were thought to be silver ore.

The ore from the Western, or McCuish mine, is a fine-grained pyrolusite, sometimes holding a little brown, or hard ore. It is generally amorphous, but the better grades show a subcrystalline structure. The McCuish ore is a soft black amorphous ore, apparently of high order. At several points considerable masses of lenticular hard ore are met, with calcspar and heavy spar. The minerals associated with the ore are calcite, baryte and limonite.

The following analyses by Mr. G. C. Hoffman, Analyst to the Geological Survey, will show the character of the ores :—

Sample No. 1.—Pyrolusite with a little manganite, gave—

Binoxide.....81·52 per cent.

Sample No. 2, consisting almost exclusively of pyrolusite, gave

Binoxide.....88·98 per cent.

Ferric oxide ..... ·21 " "

Ores represented by the above analyses would be adapted for all uses to which the mineral is usually put, and especially to glass making.

As the extent of manganiferous ground is considerable, and the quality good, it is to be hoped that these ores will form a permanent addition to the list of Cape Breton exports. Up to the close of the year 1883 about 200 tons have been shipped.

These ores have been worked by Mr. E. T. Moseley, who deserves credit for having inaugurated a new mining industry in Cape Breton County.

ART. III.—NOTE ON PECULIAR AURORÆ. BY PROF. J. G. MACGREGOR, D. SC.

TWO auroræ which I observed during the past summer exhibited a peculiarity of form sufficiently interesting to warrant my drawing the attention of the members of this Society to it.

The first was observed at Halifax on the 31st July. It had the form of a bow stretching across the sky from the east to the west point of the horizon and through a point a few degrees south of the zenith. The bow was about five degrees in width. No rayed structure could be traced in it, and its light during the greater part of its duration was very nearly uniform throughout, the whole luminous area, except at the edges of the bow, where the luminosity diminished rapidly outwards. The bow was visible from 10 to 10.30 o'clock, p.m. Towards the end of that time the east and west ends grew more faint, and the diminution of luminosity gradually extended from the ends towards the zenith. In about 15 minutes from the time at which this diminution began the bow had entirely vanished. The sky was quite clear and there were no clouds. I was unable to determine the spectrum of the bow.

The second aurora mentioned above I observed at New Glasgow, N. S., on the evening of September 5th. It had the form of a bow of the same width as the other, stretching from a point about 30° north of west to a point about 30° north of east through the zenith. It had at first a slightly marked rayed structure in the direction of its length, but this structure gradually vanished, and rays then appeared crossing the bow so as to make angles of about 45° with the direction of its length. It lasted also from about 10 to 11.30 o'clock, when it faded away, the ends fading first, and the portions near the zenith widening before disappearing. One of Hilger's larger pocket spectroscopes shewed that its spectrum consisted of two lines in the green, one bright, the other faint, and at times invisible. The sky was clear. No auroral lines were seen in the spectrum when the instrument was directed to other parts of the sky than that occupied by the bow.

ART. IV.—ON THE NORTHERN LIMIT OF WILD GRAPE VINES.

BY GEORGE LAWSON, PH. D., LL. D.

Read 14th January, 1884.

I LATELY received a letter of enquiry from Professor Blytt in reference to the Northern Limit of the Grape Vine, as bearing upon the early discovery of America by Norwegian sailors. As the exact range of our wild grapes had not been made a special subject of enquiry by botanists, and as these plants, wherever they occur, are so conspicuous as to attract the attention of persons who might overlook other plants, I requested publication of a note, for the purpose of eliciting information, in the Halifax *Morning Chronicle*, *Morning Herald*, and *Acadian Recorder*. This brought some facts which will be found in the following correspondence. It is now published in the hope that additional information may be obtained. It is not improbable that the range of Grape Vines along the Atlantic Coast region was more extensive before the country was settled than it is now, when the best lands are cleared and the country pastured by cattle. Any information on this point from old records or reliable tradition would be of special interest.

AMERICAN SPECIES OF VITIS.

The proper Grape Vine (*Vitis vinifera*) is believed to have been originally a native of the hilly region on the southern shores of the Caspian Sea, and of the Persian province of Ghilan; but it has been cultivated by man from the earliest times of which we have record, and has thus been extensively distributed over the world. It was not known, however, on the American Continent before the settlers from Europe had brought it with them. Nevertheless early voyagers speak of finding Wild Grapes on landing on the American shores. These so-called Wild Grapes are vines very distinct in character from the old-world Grape Vine, but they nevertheless consist of species of the same genus *Vitis*, several of which bear, even in the wild state, clusters of well-flavoured grapes, whilst the fruit of other kinds is acid or mawkish.

V. bipinnata, which extends through Virginia to Georgia and

west to Arkansas, has a globose depressed berry, size of a pea, blackish when ripe.

V. indivisa grows in the swamps of the Southern States, west to Louisiana and Arkansas, bearing a very small, usually one-seeded berry.

V. æstivalis, the Summer Grape, grows from Connecticut to Florida and west to Arkansas, ripening its blue, pleasantly-flavoured berries in October; original of the Clinton Grape.

V. vulpina, or Fox Grape of the South, grows in Virginia, Florida, and intervening States.

V. incisa is a Prairie Plant confined apparently to Texas and Arkansas, and has black shining berries the size of a small pea.

V. cordifolia and *V. riparia*, which are more northern in their range, have acid fruit, which sweetens after having been touched by frost, hence they are commonly called Winter Grapes to distinguish them from *V. æstivalis*, the fruit of which becomes sweet as it ripens in the sun. *V. riparia* is said to be the original of the Delaware and Taylor-Bullet grapes.

V. Labrusca, is one of the best known species which has very large leaves, and is familiar to us in its garden forms as the Isabella, Catawba, and several other well-known American grapes. Varieties of this species are distinguished by the hairiness or woolly character of the very large leaf, and comparatively large berries.

CANADIAN SPECIES.

Only three species of *Vitis* extend into Canada, viz., *Labrusca*, *cordifolia* and *riparia*.

V. Labrusca; leaves (thick 5-7 inches) broadly cordate angular, more or less lobed, the sinuses obtuse or rounded, the under surface tomentose; berries, large globose.

V. cordifolia; leaves (thin, 3-6 in.) cordate acuminate, toothed, smooth (except on the veins), berries small.

V. riparia; leaves (thin 4-6 inches) more or less deeply divided into three lobes and incisely toothed; smooth, except on the petioles, veins and margins, which are pubescent; berries small.

V. LABRUSCA, *Linn.* Canada.—*Pursh, Torrey & Gray.* Near the Falls of Niagara.—*Provancher.* Extends south to Georgia and west to Arkansas and Texas.

Torrey speaks of the fruit of the wild plant as having a strong disagreeable flavour, whilst when cultivated "it is as pleasant as any of the varieties of *Vitis vinifera.*" In Hooker's Flora (published so long ago as 1833) it is remarked that "two sorts are much esteemed at New York, and known under the name of 'Bland's-grape' and the 'Isabella-grape.'"

V. CORDIFOLIA, (*V. vulpina,* of Hook.) Shores of Lake Ontario west from Kingston; several places on the banks of the St. Lawrence, as at Thousand Islands, Brockville, La Chine, etc. Extends south through the United States to Florida and west to Arkansas.

V. RIPARIA, *Mich.* Canada.—*Mr. Cleghorn, Mrs. Percival.* Lake Huron.—*Dr. Todd,* extending to the south end of Lake Winnipeg in lat 50 degrees N., (Hook. Fl. B. A.)

Nicolet, P. Q., and Malden Ont.—*Dr. P. W. Maclagan.* Belleville, common, especially along streams.—*J. Macoun.* L'isle-aux-Coudres.—*Provancher.* Some of the localities may belong to *V. cordifolia.* Extends through the Uuited States south to Virginia and west to Arkansas.

Without specimens from the several localities, or careful determinations made on the spot by competent botanists, it is impossible to assign with certainty to their proper species the stations quoted for *V. cordifolia* and *V. riparia.* Dr. Englemann made a very careful examination of the distinctive characters of the N. American species of Vitis, and characterized *V. riparia,* as differing from its ally as follows:—"Leaves larger, usually incisely three lobed, the lobes long-pointed; panicles small, rather simple; berries larger and mostly with bloom; seeds larger, obtuse and somewhat obcordate and with an inconspicuous raphe. May, earlier than the allied species."—See Gray's Manual, fifth edition, eighth issue,—Addenda, p. 679 (January, 1868). *V. cordifolia* "has the berries black without bloom, the

small seeds rounded above and with a prominent raphe."—*Englemann.*

"*V. cordifolia* or *riparia*, grows, on the evidence of collections made on my former journeys, as far north as the south end of Lake Winnipeg, on the 50th parallel. I did not observe it on my late voyage, in which, indeed, I had very little leisure to search for plants, and, if it actually grows in so high a latitude, it does not produce edible fruit so as to attract the attention of the residents, who could give me no information respecting it. It is common in Wisconsin and Minnesota, with *V. æstivalis*."—Sir J. Richardson; Arctic Jour., II., p. 287.

CHRISTIANIA, NORWAY, 5th JULY, 1883.

Dear Sir,—My friend, Mr. J. Storm, professor of history at our university, wishes to know how far north on your coasts the wild species of Vitis (V. vulpina, Labrusca, &c.,) grow. I cannot make it out for him with the books at my disposal, so I am obliged to turn to you and trouble you with the matter. You would oblige me and my friend very much if you would be kind to let me know the northern limit of the species above mentioned in your coast districts. America was discovered some 1000 ago by Norwegian sailors, who found wild grapes at the shores and named the country after them "Vineland," which means the country of wine.

With much respect, yours,

A. BLYTT,

Professor of Botany at the University.

The Honorable Judge Ritchie informs me that, when a boy, he frequently gathered wild grapes between Annapolis Royal and Bear River, and that he has no doubt he could still find the place where the vines grow.

Professor Macdonald informs me that our esteemed President, Robert Morrow, Esq., before leaving for the South, stated that he had seen a Wild Grape vine growing in a garden at Stellarton, in Pictou County, and was told that it had been brought from the neighbouring woods. Some years later, at a distance of several

miles further up the East River, he found the Grape growing wild.

My dear Professor Lawson,—In relation to your enquiry respecting Wild Grapes, I have a recollection of past days that may suggest a quarter in which that enquiry may be successfully prosecuted.

Many years ago I lent the late Judge Haliburton an interesting book that I in vain have often endeavoured to recover. Reclamation of it is hopeless now! The author was a *Netherlander* of intelligence, who particularly mentioned an indigenous grape seen and *noted by him, of which the locality was the neighbourhood of Annapolis.*

Perhaps it might be worth your while to direct the proposed enquiry to some old inhabitant of the old French capital.

Yours ever truly,

Windsor, 9th Dec., 1883. L. M. WILKINS.

My recollection of the book and the fact referred to is distinct and you may regard it as reliable. The book was found by me among those of the Thomas family, by some of whom it was brought from Marshfield, Mass.—the ante-Revolution seat of that family—about the close of the last century.

The discovery of the author would antedate the beginning of this century.

L. M. W.

There is little doubt, I think, that a copy of the book in question is slumbering on the shelf of some Boston library. The author was not a mere traveller, but came to America on some mission for his Government.

I add a circumstance that may serve to identify:—The Book—probably on authority of a redman—indicated *phonetically* Niagara thus:—"Nee-a-gaw-raw."

Windsor, Dec. 11th., 1883. L. M. W.

BRIDGEWATER, 11th DEC., 1883.

Dear Sir,—A young Norwegian Captain just left here for Spain, told me some of their professors were to visit our land, as

he put it, in search of marks made by their countrymen long since, and a few days after I noticed in the papers that you had been consulted on the matter. My object is to let you know that there is a large rock sitting on three legs of stone, of the height of 18 inches, which I believe was put up by these old cruisers. It sits on Indian Point, near the County line between this and Queen's County. I met with it when a child, and have taken great interest in it; have frequently visited it as it puzzled me, till of late years. Should you meet those people, if you think well of it, they may easily drive to it now, but not when I used to steer my boat to where it sits. It is plainly seen from entrance of the port. Locality, Indian Point, Port Medway Harbour, Queen's County.

Respectfully yours,

E. D. DAVISON, SR.

See article on Oak Canoe, in *Scientific American*, Dec. 8th. I have a stone axe by which one could make quite a job at big work.

Just received a note from a friend informing of his having three stone relics, and I have quite a number, all from the Port Medway river, whilst nothing of the sort can I find about the LaHave River, but have two iron axes found in old graves, one having been buried at Wentsill's Lake, where bones and axes were wrapped in birch-bark.

There is an old burying ground and koche for dried salmon, &c., I expect. E. D. D.

HALIFAX, N. S., DEC. 8th., 1883.

Dear Sir,—In answer to your question about "Wild Grapes," a small sized wild grape grows in abundance on some of the islands in the St. John river, about seven miles above Fredericton, N. B. I have drank the wine made from them and it is very good.

Any more information I can give, will only be too happy to do so, and remain, Sincerely,

ALEX. IRVINE KARNEY,
International Hotel, City.

In a subsequent letter Mr. Karney observes that Mr. Michael Mitchell, Scotch Settlement, York Co., New Brunswick, is owner of the island where the grapes grow.

LIVERPOOL, N. S., DEC. 10th, 1883.

Dear Sir,—There is a grape vine said to be a wild one growing on the farm of a Mr. Hall, on the other side of Allen's Creek, close to the town of Annapolis.

I have seen and was told it was a wild one, but it may be a degenerate vine planted by the French. Seeing your letter in the *Chronicle* of the 8th inst., I thought well to mention this one. I am very intimately acquainted with the province of Nova Scotia, but do not know of any other wild vine.

Yours, &c.,

MAX D. MAJOR.

"SAINT JOHN GLOBE," EDITOR'S ROOM,

Saint John, N. B., Dec. 10th, 1883.

Dear Sir,—Wild grapes are not uncommon along the St. John River.

At Fredericton I know of several vines in gardens, which were transplanted from the woods, and some of which have seeded themselves.

Yours,

JOHN ELLIS.

ANNAPOLIS ROYAL, DEC. 10th, 1883.

Dear Doctor,—Answering your enquiries in the newspapers, I beg to inform you that I have known a wild grape vine within a mile or more of this town. In a ravine whose steep sides prevented culture, it flourished. It was surrounded by cultivated fields, cultivated no doubt by the French, before Nicholson's capture, a mile or more from the steep hills, now as then covered by the forest primeval.

It was very luxuriant, and, though I do not recollect eating the grapes, yet its flowers and half ripened berries I well remember. It was an object of curiosity to me, especially as proving the exactness of old LesCarbot, our most exact and homeliest historian. *Without knowing*, I thought it the little Fox Grape so luxuriant

on the warm south side of New England and which as a boy I knew so well—very thick skin and very tart flavor. I have no doubt it still exists, but the snow would cover it now. I hear of many other vines about here, but this is the only one I have personally seen. If you want more knowledge let me know and next spring I could send you a specimen.

B. GILPIN.

ST. JOHN, N. B., 10th DEC., 1883.

My Dear Sir,—I notice your communication in Saturday's *Chronicle* regarding the "Wild Grape" and its Northern Limit. Some years ago I was puzzled over the statement, in Demont's account of the discovery of the St. John River, that they noticed (in June 1604 or 5) grapes growing in profusion on its shores. For some time I was under the impression that they had mistaken some other vine for that of the grape. But I found afterwards that in fact the wild grape does grow in several places on the River St. John,—on the sandy points along its south-westerly bank at Westfield in King's County,—luxuriantly on some islands near Oak Point known as "Caton's Islands,"—a little further up and beyond this on the islands Oromoeld and Prince William. Curiously enough I have always heard of it on the south-westerly shore of the River or the Islands, never in a wild state on the northerly or easterly bank, nor can I discover it on the Kennibecasis tributary, where I have searched for it, as I have a summer residence at Lakeside near Hampton, where I am collecting these wild vines from Westfield, Greenwich, etc., with a view to amusing myself testing them as stocks on which to bud or graft some of the hardier improved varieties.

I am, Dear Sir, yours faithfully,

W. M. JARVIS.

FREDERICTON, N. B., DEC. 29, 1883.

My Dear Doctor Lawson,—I am in receipt of your note referring to the distribution of the wild grape in New Brunswick, but regret to say that I have little information to give upon the subject. I have gathered the fruit in some of the valleys near

Fredericton, as at the Falls of the Nashwakasis, and it is quite common on the intervales and islands of the St. John River above this place, but I have never made any special notes regarding its occurrence. I think it likely that Mr. Matthew may be able to tell you something more about it, especially in the southern counties.

I am, Sir, &c.,

I. W. BAILEY.

To the Editor of the Morning Chronicle:

Sir,—In regard to Professor Lawson's enquiry about localities where the wild grape vine is found on the Atlantic coast of this part of America, I would beg to state that I have studied the botany of Prince Edward Island carefully for years and have never seen anything of this plant here.

There is apt to be a great incorrectness in the reports of unskilled observers on plants. Some species of our wild brambles which have a climbing habit, as *Rubus occidentalis*, might be mistaken for *Vitis*.

Yours,

FRANCIS BAIN.

North River, P. E. I.

The information so far obtained shows that the present most northerly points of the Wild Grape (Vitis cordifolia, or its near ally V. riparia) are the following:—

Annapolis Royal, Co. Annapolis.

West River, Co. Pictou.

St. John River, New Brunswick.

Isle aux Coudres, St. Lawrence River.

ART. V.—SABLE ISLAND, (CONTINUED.) BY S. D. MACDONALD, F. G. S.

Read Feb. 10, 1884.

IN my former Paper on Sable Island I introduced to your notice its general features, intending at some future time taking up and working out in detail, some of its most remarkable points of interest. To-night I would call your attention to some of the many changes it has undergone, which have materially altered its position.

On the early charts of this coast compiled and corrected from those of the French, and published in 1775, this island is shown as occupying a position between 60° 05′ and 60° 45′ W. long., 40 miles in length and 2¼ miles in breadth.

In 1799 a special survey of this island was ordered by the admiralty, and the chart we have before us this evening was issued together with numerous views of its appearance from different points of approach, also a scene of what is evidently an encampment of shipwrecked persons among the east end, naked sand hills. Many of the party are dressed in antique costumes, cocked hats, &c.

Those naked sand hills have always been an object of peculiar interest here, owing to their assuming such fantastic shapes, and by their colour, being more readily seen in the distance. Viewed in this engraving they appear to have attained quite an elevation.

On a plan published by Mr. Darby, one of the superintendents, is a cone shaped drift at the western extremity, marked the "volcano," said to be upwards of 100 feet in height, similar to one of those represented in this engraving. But the volcano has been dispersed. The position it occupied passed seaward many years ago, and now lies fathoms deep.

This survey appears to have been a very elaborate one and well prepared, upwards of 500 soundings are represented in the immediate vicinity of the island, and on the bank. This has resulted in locating the island as follows:

West end 60° 32′, east end 60° 01′. Length 31 miles, breadth 2 miles. Showing a decided decrease in area since previous observation, and placing the west end 22 miles further east.

The next survey was that of 1808 of the Island proper, ordered by General Sir George Prevost, then Governor of this Province, who moved by the terrible circumstances attending the loss of the troop ship "Princess Amelia," made every effort to induce the British Government to erect or aid in the erection of a light house on the Island.

Lieut. Burton of the Fusiliers, then stationed at Halifax, was dispatched to report on the feasibility of erecting a light, and to inquire into the wants of the Island.

From this report we learn the Island was 30 miles in length and 2 miles in breadth, with hills from 150 to 200 feet, beginning at west end and attaining their greatest elevation at Mount Knight, its eastern extremity.

Just a few words here with regard to the correctness of this first chart. It may be thought by some that little dependence should be placed on a chart compiled at a time when so little was known of the coast. But we have only to remember that this Island was well known to the French as early as 1598, and that forty years previous to this chart being compiled the walled City of Louisburg was at the zenith of its prosperity, with its magnificent fortresses which were 30 years in building at a cost of five millions five hundred thousand dollars, the station of a powerful French fleet which for armament and numbers has never been seen in North American waters since, and a city whose commerce was of no little importance.

Then, as now, in early springtime the Gulf of St. Lawrence current brought down its fields of ice blockading the south shores of Cape Breton. To avoid which those cruisers and merchantmen bound for the harbour of Louisburg were compelled to run south and westward, making an off shore approach which would throw them in the immediate vicinity of the Island. Also on two occasions a British besieging squadron lay before that city and cruised off its shores, the strength of which can be estimated when we learn that on one of those occasions 140 sail, of which 36 were frigates and ships of the line, left Halifax for Louisburg in a single day.

All this seems to warrant the conclusion that the knowledge

possessed in early times of the coast and the adjacent islands was even greater than ours of to-day. And it is difficult indeed to give a satisfactory explanation of the variation of those charts unless we attribute it to actual changes undergone. But let us proceed.

In 1850 the late Hon. Joseph Howe visited this place as commissioner, for the purpose of making himself personally acquainted with the Island and its requirements. In his report he called the attention of Parliament to the rather startling fact, that by actual measurement the island had decreased at the west end 11 miles in the last 30 years. And further, for the safety of navigation and the prevention of disasters their first duty with regard to Sable Island was to have the position defined.

In the cabin of the "Daring" before him lay a chart by which that vessel was supposed to be navigated, also another compiled from observations taken by Capt. Darby in 1829. The discrepancy between which, and its possible effect on navigation, was appaling to contemplate.

The variations were as follows:—

The cutter's chart, W. E. 60° 32′ W. lon.
" " E. E. 60° 03′ "
Darby's chart, W. E. 60° 10′ W. lon.
" E. E. 59° 48′ "
Difference 22 miles.

This chart on board the cutter appears to have been one issued about 1815, on which the island is made to be 29 miles in length, a difference of 2 miles smaller than the chart of 1799.

On the strength of Mr. Howe's report, the admiral was communicated with, who ordered Commander Bayfield and staff to the island for the purpose of making a new survey. A corrected chart was issued by Bayfield the following year, locating the Island as follows: W. E. 60.08., E. E. 59.45., showing a still further reduction of area, and placing the west end 2 miles still further eastward than shown by Darby's chart of 1829.

Surprising as this evidence of change may appear it is fully borne out by the testimony of all those whom fortune has led in the interests of humanity to dwell upon its shores.

The position chosen for the main station in 1802 was one remarkably sheltered among the sand hummocks at a distance of 5 miles from the west end.

In 1814 the superintendent, Mr. Hudson, wrote the Government, that owing to the rapid manner in which the island was being washed away it would be necessary for him to remove the establishment to a more secure position; that within 4 years previous, 4 miles had gone entirely from the west end, leaving but a mile between him and the sea, which was advancing steadily. On the north side an area equal to 40 ft. wide and 3 miles long had gone bodily from the island during a single night. He intended moving the buildings to a place called "Middle Houses," 3 miles further east.

In 1820 the superintendent again wrote the Government, "that not only had the old site of the main station gone seaward; but the sea was again encroaching to such an alarming extent that he would be obliged to once more remove the station, and had selected a place known as the "Haul over," 4 miles further east. This moving of the main station incurred no little trouble consisting as it did of superintendent's dwelling, another for the staff, a sailor's home for the accommodation of shipwrecked persons, stores for provisions and material saved from wrecks, barns, workshops, boat house, &c.

Again the sea advanced, the two following winters were noted for the frequency of storms and the havoc made along the sand cliffs, every gale sensibly diminishing the western portion of the island, toppling great masses of sand hills into the surf below as well as changing the surface of the interior. One instance I have already mentioned in my last paper when thousands of tons of sand were carried from the beach and strewn over the island, smothering vegetation, so that hundreds of horses died for want of food.

Seeing the necessity of securing more permanency for the main station, and the buildings from being so often removed, becoming dilapidated, the present position was selected on the broadest and most protected portion of the Island and new buildings erected in 1833. The old dwelling of the superinten-

dent was again removed 4 miles further east and used as a house of refuge. Here it enjoyed a short respite when again the sea threatened its foundation. This marks the 11 mile point mentioned in Mr. Howe's report.

Now all this seems so much like romance that were it not for the authenticity given it by parliamentary reports and the records of the Island, I should hesitate in giving currency to these statements.

But I think I hear you say,—What of that house—is it still moving?

No, it is now at rest, it has found a grave, for the fourth time it was moved, this time 2 miles further east. Gradually the gales removed the hummocks that sheltered it. Then, left to the rake of the winds, sand laden eddies twirled about it till slowly mound arose closing it from sight, the house, and the surface became levelled out above it.

Another short rest and again it may open up to view, and be bared to its foundation, or be thrown down with the embankment and floated away by the current.

Between the years 1850 and 1881 this western portion of the island appeared to enjoy a period of comparative repose. This may be accounted for by the fact that so much material had been thrown down a shoal was formed to the west on which the seas would probably break before reaching the sand bluffs and thus lose their abrading force. In the same manner the main body of the island is defended by three parallel bars which act as barrier reef, and protect or at least retard the work of devastation which would otherwise proceed with great activity. On the removal of this shoal to the westward, by the currents, the seas began again to manifest their force.

The winter of 1881 was remarkably stormy, gale succeeding gale in quick succession. In addition to this gradual work of erosion great areas were removed bodily. During one gale 70 feet by ¼ mile departed, a month later 30 feet of the whole width of the island disappeared in a few hours.

The winter of 1882 was even worse than the preceding one, and was noted for the destruction wrought among the buildings,

including the west end light house, a magnificent structure erected in 1873, one mile inside the grass hills.

Early in Feb'y. of that year a gale of unusual violence visited the Island accompanied by very high tides; already the sea had removed the embankment to within 40 feet of the bluff on which the light house keeper's barn stood, and within dangerous proximity to the light house itself. As the tide rose the gale increased. All hands were now out ready for any emergency that might require their presence.

The cattle had been removed to the porch of the light house. As the staff were watching the force of the waves that were now undermining the embankment with great rapidity, suddenly a depression along the margin of the cliff gave warning of a downfall. The next instant an area equal to 48 feet broad and a $\frac{1}{4}$ of a mile long descended into the surges on the north side, while during the night the 40 feet in front of the barn and along the sand bluff dissappeared; next morning the barn went crashing below and was swiftly carried away by the current.

The storms that produce the most destruction are those from the S. E. bringing in heavy seas, which striking obliquely on the south shore aided by the powerful current setting to the west erode the sand cliffs until large masses are detached, fall into the current, and are carried forward. This also helps to prolong the N. W. Bar.

Again, during calm weather when winds and waves are still, the shores and bars are white with foam from the ever present ground swell which renders landing so precarious; it is seldom attempted except by the surf boats at the station.

In the loss of the west end light-house we have a remarkable instance of the wasting force of this swell. The weather had been unusually quiet for the space of two days, during which time a heavy ground swell hove in from the S. E., (probably from a gale passing along the gulf stream), which carried away the remaining 12 feet of embankment in front of the light house, causing it to lean dangerously forward, and necessitated the hasty removal of the apparatus. From this time the light ceased to send its warning across the waves.

While changes are readily observed along the bluffs the beach itself is continually varying in form, increasing and diminishing in particular parts. In this way old wrecks are brought to the surface and others concealed during a single gale.

Some years ago, after a heavy gale, spars, canvas huts, &c., showing a prolonged stay of which there is no record, were discovered. This spot has also passed under the sea.

In 1837 Mr. Miller, the third commissioner appointed to enquire into the possibility of erecting a light house, reported that on visiting the Island he found the position chosen by him in 1833 had undergone a complete change. The site selected by a former commissioner favorable to the project, had been completely removed by the high winds that have at times so much effect in causing remarkable changes in the interior, as well as on the shores of the Island. He would only feel justified in recommending a temporary erection, such as could be easily removed to a more permanent position when necessity required it.

We can readily understand how hills of loose sand thrown up by the wind into every fantastic shape that snow drifts can assume, are ever changing their extent and position.

The removal of those sand drifts or dunes have brought some interesting historical facts to light.

In 1842 during a severe gale an old landmark in the form of a pyramid near the west end station, said to be 100 feet in height, was completely blown away, exposing to view several small houses built from the timbers and plank of a vessel; on examination they were found to contain quite a number of articles of furniture, stores put in boxes, bales of blankets, quantities of military shoes, and among other articles a dog collar of brass, on which was engraved the name of Major Elliot, 43rd Regt.

It was afterwards ascertained that this regiment while returning to Halifax after the siege of Quebec, was wrecked here, but afterwards taken off without loss of life.

Many years ago a roundsman's attention was attracted to a blackened line along the sand cliff; on climbing to the place and removing the sand he uncovered what afterwards proved to be the

site of an old encampment. Here lay rusty guns and bayonets, knives made from iron hoops, broken glass, a tattered English ensign, human bones, mingled with those of cattle and seals, an English shilling of the reign of Queen Elizabeth, sharp as when taken from the mint which furnishes the date of the disaster. But nothing further left to give a clue to the sufferers, except that they were Englishmen.

Thus those gales are ever bringing to view, evidence of calamity of which history and tradition are equally silent.

Turning to the lake we find more proof of the vicissitudes this Island has undergone. When first known the lake had an opening on the north side which was afterwards closed. A few years later during a terrific storm the seas forced a channel through the lake margin on the south side rendering it a convenient harbour for small vessels. But in 1836 a similar tempest closed it again, shutting in two American fishermen, who ran in for shelter on seeing the storm approaching.

Gradually it became very shoal from the material drifting into it, but being dammed up by the closing of the inlet and filled by the surf washing across the ridge, it afforded great facility for forwarding the life boat in case of a wreck, and the transport of wrecked material to main station for shipment.

During the winter of 1881, a severe gale opened a gulch towards the east end, so draining it as to reduce it to 8 miles in length and rendering it useless as a means of transport.

The lake margin forming the south shore in like manner testifies to the destructive agency of the sea. Having a breadth at one time of ½ a mile, with sand hills of upwards of 50 feet in height; at present it is merely a narrow ridge forming a precarious sea wall, over which the waves now break in heavy weather. Should this inner barrier be removed the work of demolition will go forward with increased rapidity.

During storms, in addition to the actions of waves and currents, the winds independently ravage its surface.

Finding a raw spot, as it is termed, the eddying winds scoop out the loose sand (when not confined by the roots of the grass) into bowl-like depressions, which afterwards form those fresh

water ponds so often found in the interior, while around the stations it requires the utmost vigilance of the men to watch the first break in the sod and repair it before headway is gained, otherwise the buildings would soon go from their foundations.

While the wind and waves have been so active modelling and remodelling the Island proper, currents and eddies have also been at work on its submerged portion, although from the difficulties attending observations we are not cognizant of the various changes taking place. One however, fraught with much danger, is making itself manifest in a painful degree, that is, the prolonging and shoaling of the north east bar.

By reference to this wreck chart, it will be seen that most of the wrecks of late years have occurred here, some of them being as much as 16 miles from the light.

The changing character of the bar at the other extremity of the Island may be inferred from an extract of Capt. Darby's reports in Blunt's Coast Pilot of 1832, as follows:—

"I have known this Island for 28 years, during which time the west end has decreased in length 7 miles, although the outer breakers of the N. W. bar have the same bearings from the west end of the Island as they formerly had, demonstrating that the whole bank and bar are travelling eastward."

With regard to this Island having travelled the entire distance shown by those charts, it would be rather hazardous to adopt such a conclusion. Yet it is certain that its progress eastward is in keeping with the natural tendency of all sand accumulations, and although the material may be carried sometimes one way and sometimes another, yet nevertheless its progress must still be in the direction of the prevailing wind.

In some parts of the world in consequence of the preponderance of certain strong winds in one direction, such accumulations make a regular progressive movement, and have buried farms, houses, cities, and even whole tracts of country, of which there are numerous instances on the English and French coasts.

At this island the strong west wind is as constant as a trade wind, and its material is being constantly blown before it.

In this way the amount drafted from west to east must have

been enormous and may account to a great extent for the diminished height of the Island. At the same time I think we are justified in concluding, that while the Island has traversed a certain portion of this distance, its changed position as here indicated by those admiralty surveys, is mostly due to submergence.

Of course an Island so constituted, exposed to the unobstructed violence of the whole Atlantic, could not long resist the terrible abrading force of the breakers, aided by swift currents, and the denuding effects of wind and rain.

Already we have seen that within a comparatively short space of time, dating back but a few years previous to the founding of the life saving station, it has decreased in length from 40 miles to 22; in breadth from 2½ miles to something less than 1 mile; in height from 200 feet given in 1808 to 80 feet, according to the latest observations.

The future of this Island to the navigator is everything but cheering. Should those destructive forces now in operation continue, we might easily calculate on a period, and not a remote one, when the sea will claim it as its own.

ART. VI.—GLACIAL ACTION, AT RIMOUSKI, CANADA, AND LOCH ECK, ARGYLESHIRE, SCOTLAND. BY REV. D. HONEYMAN, D. C. L., F. S. A., &c., *Curator of Provincial Museum.*

(Read. 10th March 1884.)

ON the 3rd of last November I made an observation near the I. C. R. Station at Rimouski, which I regard as interesting. On both sides of the Road I found and examined boulders, many of which were of large size; one had been blasted to make way for a fence. Others were evidently undisturbed, being, doubtless, in the positions in which they had been deposited during the glacial epoch. They are of crystalline rocks, of the Archæan (Laurentian,) formation. There are no exposures of rocks in the vicinity.

From what I have seen of the rocks in the district I have no hesitation in regarding the boulders as travellers from a distance. The Laurentian Formation lies on the north side of the river (St. Lawrence,) at a distance of 20 miles from the position of the boulders. They have travelled a distance, of at least 27 miles. Specimens of the boulders before you are, first, a beautifully banded gneiss having black mica (muscovite) and white quartz; second, also beautifully banded having black mica and reddish quartz; third, is of black mica and yellowish quartz; it is also banded but not so beautifully as the other two. On two other occasions I was in this locality, but without time to make any observations. The transportation observed was not unexpected. In Sir W. E. Logan's table on glaciation, I found that at Kempt Road near Metapedia Lake, Lat. 48° 32', Long. 67° 43', there is glaciation having a course of S. 80° E. On the admiralty chart I had also observed that the glaciation of Point Pleasant extended N. E. passes through Rimouski at a distance of 310 miles. The longitude of Rimouski is 68° 32', and the latitude is 48° 28'.

The striation at Metapedia Lake, if extended in the direction of Rimouski would pass considerably to the north of the boulders, as the latitude of the one is 6' north of the latitude of the other, and the longitude 49' less. In my last paper on Glacial Transportation I observed that the extreme points of my observations were George's Bay, Antigonish, N. S., Long. 62°, and Kingston, Ontario, Long. 76° 29'. Two other extreme points are Halifax, N. S., latitude, 44° 44', lat. 48° 22', and Rimouski, Quebec.

LOCH ECK, ARGYLESHIRE, SCOTLAND.

In the month of July I had an opportunity of making some geological observations in the West of Scotland, especially in a corner of Argyleshire, at the Firth of the Clyde and Loch Long. My headquarters there were Blairmore. On the shore are interesting exposures of strata which are evidently near the Geological horizon of our own Cambro-Silurian formation. These are b^{1}, b^{3}. b^{4}, Silurian, Clay, Chlorite, Mica, Slate, and Gneissose rocks, based on quartzose, flagstones, quartz rock, &c. Vide Murchison & Geikie's First Sketch of a New Geological Map of Scotland, 1861. From Blairmore I proceeded to Kilmun, thus passing

farther along b^3. Then taking a course N. E., towards Loch Eck, I passed through b^c and into b^4, going beyond Ben More, at the beginning of Loch Eck my attention was attracted to a rock on the right side of the road. This was furrowed by familiar glaciation, unfortunately I did not have my compass to take the course of the striation. It was apparently towards the S. E. The rock itself is a micaceous schist. We followed the course of the River Echaig, as far as its falls. The water was low at the time and gave an excellent opportunity of examining the magnificent exposure of schist. It is wonderfully worn and excavated by the action of the water, which passes through a narrow gorge. The rock is replete with pot holes, some have had sides worn and the boulders have escaped. Looking at the lofty hill ridges on either side of the valley, and beyond the falls, one is impressed with the adaptation of the position for an Alpine glacier. Of course other geologists have noticed this, although I have failed, on enquiry, of learning the fact.

ART. VII—NOTES OF A POLARISCOPIC AND MICROSCOPIC EXAMINATION OF CRYSTALLINE ROCKS OF NOVA SCOTIA AND CAPE BRETON.

BY REV. D. HONEYMAN, D. C. L., F. R. S. C.

(Read 11th Feb. 1884.)

INTRODUCTION.

1. Basalt.....of Blomidon, N. S.
2. (boulder.).....Weymouth.
3. Basalt.....Jebogue Point, Yarmouth.
4. Diorite.....St. Peter's Canal, Cape Breton.
5. Diorite.....Cranberry Head.
6. Diorite..... Nictaux.
7. Diorite.....Cobequid Mountains.
8. Porphyrite.....Sunday Point, Yarmouth.
9. Porphyritic & Amygdaloidal..Cobequid Mountains.
10. Porphyrite.....Cobequid Mountains.
11. Hornblendic rock.....Yarmouth Harbour.

I have had sections of the preceding rocks carefully prepared by Dr. Alexis S. Julien, New York. Four of them have already been imperfectly examined by an inferior polariscope. I have re-examined these thoroughly by the splendid new Polariscope-Microscope made by Anderson & Sons, London, for our President, and added the other seven to the number; and I propose in these notes to give an account of the interesting results and to illustrate with the instrument.

DOLERITES.

1st. I begin with the Blomidon Basalt, as this mountain is well known wherever Nova Scotian mineralogy is an object of study. Its zeolites and other minerals are to be found in all great museums, and it is noted in works on general mineralogy as one of the principal localities where trappean minerals can be collected. The section examined is of a compact basaltic prism which I picked up at the foot of the mountain in 1875, *(a.)* Examined by the Polariscope, with *nicols* crossed, the section is brilliant and striking. Revolving the Polariser or Analyser, as both can be turned, the change in prismatic colours, and their arrangement is kaleidoscopic. The abounding parallel lines with changing and alternating colours (trichoic) indicate combinations of crystals into twins, three lings and four lings, with chroism of labradorite, among these is a constant, unchanging brown colour, this distinguishes augite from hornblende, which is dichroic. We have thus indicated the two minerals which constitute a *dolerite*. When the *nicols* are crossed parts of the section have a vivid chromatic polarisation. This is owing to the presence of quartz. There is also another obvious constitutent which is opaque. All that we can distinguish with the polariscope is the presence of dark forms with acute angles or of irregular shape. (*b.*) Removing the polariser and analyser we then examine them in sunshine with the microscope, the dark forms are seen to be blue-black in colour with metallic lustre. This shows that it is the mineral *magnetite*. Surveying, then, the whole section we find a large number of these. At the same time we detect green specks of olivine. The basalt is therefore dolerite, consisting of labradorite and augite with the accidental minerals, quartz, magnetite

and olivine. 2nd. A boulder of Basalt. When I was surveying parts of the Counties of Digby and Yarmouth, Trans. Inst. 187, I observed at the Weymouth Station of the Railway a large, rough-looking boulder; breaking part of it I found it to be basaltic. It was considerably weathered and easily broken. Examining the pieces macroscopically I found it replete with crystals of olivine of considerable size. These, like the rock, had suffered from decomposition and were very friable. Regarding it as different from the basalt of Blomidon in having olivine, I called it an "Olivine Basalt." The examination of the preceding basalt shews that this is a useless distinction. As fas as I can find this is the first time that olivine has been found in these basalts. (*a.*) Examined with crossed *nicols* the section of this boulder surpasses the other in brilliancy. The crystals are similarly pervaded by parallel lines. Turning the polariser, these are also trichroic. Before the polariser is turned, the vivid chromatic polarisation of the quartz is greater than that of the preceding section. The unchanging greenish brown colour shows the presence of augite, dark forms are also seen but they are small. A crystal of olivine of bright green colour adds to the variety. (*b.*) Examined by the microscope in sunshine, the small dark forms are seen to be of magnetite and to be arranged in groups rather prettily. The crystal of olivine is seen to be surrounded with a decayed crust which has lost its green color. Smaller crystals, (broken,) are seen in different parts of the section. The constituents of the boulder are thus, labradorite, augite, quartz, olivine, magnetite.

2nd. Basaltic dyke at Jebogue Point. I have partially described this already, as peculiar and interesting because penetrating Cambro Silurian rocks. I would now describe the section more particularly. (*a.*) In the polariscope with crossed nicols, it appears dark, with faintish light, excepting when it is surveyed throughout, the crystals of good size are seen divided by a median line. Turning the polariser these crystals are brilliantly trichoic. They are therefore labradorite twins. Numerous small crystals are also seen, which are also trichroic and give considerable brightness to the section when the nicols are parallel. The dark brown colour is constant, indicating a predominance of augite.

Occasional bright spots with quartz polarisation occur. Other sections might shew more of this, as a macroscopic examination of the rock shews amygdules of quartz, and grains in abundance. (*b*) Examined with the microscope, numerous black grains combine with the augite to darken the section. These are seen to be magnetite. Brassy crystals are also of frequent occurrence. These are of pyrite. Olivine is not observed in this section. The minerals in this basalt are thus labradorite, augite, quartz, magnetite, pyrite. This rock has the same essential minerals as the two preceding, and is a dolerite. They differ in proportion. It has the same accidental minerals only *pyrite* takes the place of olivine. Is the third identical with the first and second? Or is it part of an older rock than these?

DIORITES.

4. I take as a typical diorite a crystalline rock which occurs in Cape Breton, in that narrow neck of land which separated the waters of the Atlantic and the inland waters of Cape Breton but which have recently been connected by St. Peter's Canal. The specimen which furnished my section is one of a collection made at different depths in the process of excavating the canal, and kindly presented to the Museum by a gentleman residing in the locality. I visited the locality in 1861, after the excavation had been begun and work suspended. I then noticed the rock but did not examine it particularly. The Geological formation of the locality is Carboniferous. I collected *flora* in the vicinity, the precise relation of the rock to the formation may be uncertain, it is likely a pre-carboniferous diorite. (*a.*) Examined with crossed *nicols*, it is more beautiful than any of the sections already described. Seven prismatic colours, violet, blue, orange, yellow, &c., are arranged in four groups and in parallel lines. This is pleochroism in the strictest sense. In an orange colored crystal there are 7 parallel lines. Turning the polariser this becomes trichroic, but without alternation between the parallels. A very beautiful group of colors show the arrangement from left to right, deep blue, violet, yellow, orange. yellow, violet, light blue in parallel lines. Turning the polarizer from left to right about half a revolution the arrangement

changes to yellow, dark blue, light blue, yellow, orange. We have thus a triclinal feldspar, oligoclase. Crossing the nicols, we observe on the right side of the last described, a lovely green, giving the polariser half a turn the green is changed to a bright purple. This is a dichroism indicating hornblende. Surveying the field while turning the polarizer the pleochroism and dichroism is constantly appearing. The rock is thus evidently a diorite, there are also black forms constantly appearing. *(b.)* Examining there with the Microscope they are seen to consist of magnetite and pyrite. The minerals of the rock are oligoclase, hornblende, magnetite, pyrite.

5. This is the section of a rock which I observed at Cranberry Head, Yarmouth County. It is associated with Lower Cambrian rocks, and in close proximity to the auriferous strata of the gold mine. On this account it is singular and interesting. *(Vide paper, Transactions.)* I described it as a diorite. Looking at the section with crossed nicols, we see a pleochrism of pretty much the same character as that of the preceding, but not so brilliant. Turning the polariser, the changes also bear a close resemblance. Parallel lines are equally numerous. There is also a corresponding dichroism throughout the section. We have thus as constituents of the rock oligoclase and hornblende. There is also mica, an accidental mineral, whose presence is readily enough observed macroscopically. Opaque forms are abundant. *(b.)* The microscope shows that the opaque forms are of magnetite and pyrite. The minerals of this rock are oligoclase, hornblende, mica, magnetite and pyrite.

6. Diorite of Nictaux. The rock of our section belongs to a very important series of intrusive rocks which I have pointed out and described in my papers (1) "On the Geology of Kings Counties;" (2) "On the Geology of Annapolis County;" (3) "On the Geology of Digby and Yarmouth Counties." *(Vide Transactions.)*

On geological considerations, and from macroscopical examinations, I have named these diorites. Members of the series have been pointed out as occupying the dividing line between the lower and middle Silurian and the lower Cambrian (auriferous)

formation at Nictaux, Bear's River and Cape Cove, Cape St, Mary's, Bay of Fundy. These diorites have themselves been referred to post-upper Silurian and pre-carboniferous (Devonian) time, with similar rocks of *undoubted* Devonian age, at Arisaig, Antigonish County, and East River, Pictou County. *(Vide papers in Transactions.)* Of these I intend to have sections prepared for subsequent examination.

(a.) One section examined by the polariscope, with crossed nicols and revolving polariser, shew, first, a brilliant dichroism indicating the existence of a large proportion of hornblende. The other chief constituent mineral is a triclinic feldspar albite. That the feldspar is triclinic is evident from the forms of the crystals, medium lines, twining, and other parallels. When the nicols are crossed these are distinctly seen. There are no prismatic colours between the parallels. The colors in this case are purplish, grey and white. Turning the polariser these are seen to change from light to dark, or *vice versa.* (In the Blomidon basalt section there occur, often, crystals having the same character.) There are also opaque forms in considerable number. *(b.)* Examined by the microscope these appear as magnetites and pyrites.

The minerals of this rock are albite, hornblende, magnetite and pyrite.

7. Diorite of the Intercolonial Railway, Cobequid mountains. In the Wentworth cutting I have pointed out the singular association of Lower Silurian claystones, having characteristic fossils with crystalline rocks which have every appearance of being interbedded igneous rocks. I characterized them as *homogeneous* diorites—*(Vide* papers "Geology of the I. C. R.,"—*Trans.* 1873.) —they appeared so *macroscopically.* I have selected one of these as a representative of this series and had a section made. This is far from being *microscopically* homogenous; so that the term "homogeneous" is no longer appplicable to these rocks. *(a.)* Examined by the polariscope it shows much dichroism from the prevalence of hornblende. The predominence of light crystals with median and other parallel lines, indicate the prevalence of triclinic feldspar. The colours within the parallels resemble those

of the preceding (Nictaux) section, and indicate albite. The rock is therefore a diorite. Opaque forms are numerous. *(b.)* These examined by the microscope are seen to be pyrite and magnetite. The pyrite is readily seen in the rock with a pocket magnifier. The minerals are hornblende, albite, pyrite and magnetite.

PORPHYRITES.

8. Sunday Point Porphyrite. Macroscopically this rock consists of a darkish groundmass, with light colored crystals plentifully distributed; hence I have named it porphyrite. Mica is also observed as a prominent mineral. *(a.)* The section examined by the polariscope, with crossed nicols, and the turning of the polarizer, show the crystals with parallels and pleochroism only inferior to that of St. Peter's Canal typical diorite section, and surpassing that of Cranberry Head. The groundmass itself is evidently largely composed of oligoclase. Dichroism shows that another constituent is hornblende. The rock is therefore a diorite-porphyry. The opacity of the groundmass arises, to a large extent, from the abundance of black granules, clouded spots and dark grains. *(b.)* These examined by the microscope are seen to consist of magnetite and pyrite. Mica is also present. The constituent minerals of the porphyrite are thus: oligoclase, hornblende, mica, magnetite and pyrite. Sunday Point is situate at the mouth of Yarmouth Harbour, between the latter and Jebogue Point. It is nearer to the latter than to Cranberry Head. Our polariscopic and microscopic analyses show, however, that the crystalline rock of Sunday Point is more closely related to that of Cranberry Head than it is to that of Jebogue Point, and that they may belong to two different eruptions, ages apart.

9. Porphyrite and amygdaloid diorite of Cobequid mountains, near Wentworth station, I. C. R. In my paper on the I. C. R., I described a very coarse conglomerate, consisting largely of volcanic constituents. This seems to have been the product of a sub-marine volcano of Lower Silurian or Upper Cambrian age. Part of this conglomerate was a singular and rather beautiful rock, having a green groundmass, with amygdules of white calcite and crystals of reddish feldspar.(?) This is the rock of our sec-

tion. The groundmass transmits polarised light with the nicols crossed, and brightens considerably with the turning of the polariser. Its dichroism shows that one constituent is hornblende. Crystals interspersed, having median lines and the general colours, seem to indicate albite as also a constituent. The red crystals which led me to characterize it as porphyrite, are of uncertain character, not having any distinguishing feature. The amygdules which I consider to be calcite, show a varied and beautiful *chroism*. One or two of these are pervaded by fine parallel lines which are sometimes crossed by other parallels. The turning of the polariser does not much affect this striation. It is not, therefore, of the character of the feldspar striation. Some of the amygdules are of a yellow colour; three of these are in the section with the nicols crossed; these are green and black, so arranged as to appear to radiate from the centre. Turning the polariser half a revolution, they become yellow, without the appearance of radiation. The mineral is evidently *dichroic*. I do not know what it is. There are also dark forms in the groundmass. *(b.)* The microscope shows that these are magnetite. The constituents of this rock are therefore hornblende, albite, calcite, magnetite and (?) mineral.

10. In the second of the Whetstone Brook sections which succeed the Wentworth, I. C. R. is porphyrite which is associated with Diorites. The slates which include them have only produced one fossil a large *lingala*. They have been referred doubtfully to the middle silurian period. *(Vide,)* paper already referred to. This porphyrite has a dark ground mass in which are scattered reddish crystals and kernels of hyaline quartz. *(a.)* In section the ground mass transmits light with crossnicols and brightens with rotation of the polariser, hornblende is evidently one constituent.

The sections of the reddish crystals are dichroic, the mineral is therefore monclinic, orthoclase. One has four different shades of color (brown,) irregular dividing lines which deepen in different degrees with the rotation of the polariscope, and after half a rotation or a little more, becomes white (grey.) One of these has a distinct inclusion (mineral.) The hyaline quartz is of a dark blue when the nicols are crossed. The ground mass is unindividualized. *(a.)*

The microscope shows magnetite in grains. The rock is thus composed of hornblende albite (?) quartz and magnetite.

11. At the head of Yarmouth Harbor is a peculiar hornblendic rock. In the paper on the Geology of Digby and Yarmouth, this rock has been pointed out. In my other paper on Polariscopic examination, I have referred to some of the peculiarities of a section of it. I referred to part of its hornblende with a singular, glassy inclusion. I have now ascertained the character of the other chief constitutent of this rock. Comparing it with the section of a typical quartzite, I find it has a similiar dichroism, blue and yellow, only the granulation of the rock is much finer. It requires a higher power to distinguish it, when the polarizer is not used. Glassy portions which do not transmit light, with the crossed nicols occur in the quartz constituent of the rock as well as in the hornblende. *(b.)* The microscope shews these to be magnetite. The constitutents of this rock are therefore, quartz, hornblende, magnetite, glass with or without inclusions. The rock is metamorphic and of Lower Cambrian age.

Inferences.

There are several interesting points that are brought into prominence by these examinations.

1st. The value of the Polariscope and Microscope to the practical geologist. This is evident from the correspondence between observation in the Field and the Polariscope-microscope and from the comparison of observations in my published papers with the observations just submitted. The names given to rocks examined in the Field are in accordance with the names which the Polariscope and Microscope designate, and conclusions arrived at there have been confirmed by the process of examination.

2. In every rock examined magnetite is found. It is thus seen to be distributed far more extensively than we could have ascertained without the aid of the microscope.

4. It reveals to us the origin of some of our magnetic sands, *e.g.*, magnetite was found among the gold and garnet sand at Jegoggin Point. The source of the garnets was obvious and the probable source of the gold was indicated. That of the magnetite only was uncertain. Hornblendic rocks, like these of Yarmouth

Harbour, occur at Jegoggin Point. From these we may have the supply of magnetite.

The magnetite represented by the sections described has also been rendered obvious by reducing pieces of the rocks to a powder in a wedgewood mortar and extracting the magnetite with a magnet.

ART. VIII.—SOME PHYSICAL FEATURES OF NOVA SCOTIA, WITH NOTES ON GLACIAL ACTION.

By M. MURPHY, C.E., *Provincial Government Engineer.*

(Read April 14, 1884.)

FROM the year 1869 to 1872 it was my duty to survey some of the Gold Districts which lie in various directions along the Atlantic slope of the Province; and subsequently it became a no less pleasing one to conduct some railway surveys, the course of which was right across the general direction of the strike of the gold-bearing rocks. During these labours and journeyings my work was entirely confined to surveys and public works. Such observations as I was able to make of a general scientific character, were necessarily incidental, hasty and external; however, these defects of hurried and superficial observation will be found in the details only. I am able to place before you a correct representation of the geological skeleton, the characteristic outlines, and true topographical section on two lines of profile across the province, between the Bay of Fundy and the Atlantic shore. The line of railway in operation from Halifax to Windsor gives a third such profile. All are between the 44th and 46th meridians, and are nearly parallel to one another. These sections or profiles may be said to possess advantages in facilitating the formation of more comprehensive views on the

large scale, and may also tend to enable other and more definite contributors or observers, by adding one range of vision to another, to take in at a glance a much more concise perception of the extent and general outline of their more prominent features.

The sea board of the south-east coast, between Cape Canso to the north-east and Cape Sable to the south-west, is no less than 230 miles in a straight line, the general trend being about east-by-north and west-by-south. Throughout the whole extent of this rocky coast, say "The Sailing Directions," are numerous "indentations, varying in size and utility, from the narrow creek "in which boats seek shelter, to noble harbours, of which Halifax "is the largest, most accessible and safest."

A well defined low mountain ridge courses with nearly the same trend as the shore line, and forms the principal water-shed of the Peninsula; its slopes run northerly and southerly from it, the latter, or southern slope, being somewhat undulatory, but regular in its descent to the Atlantic.

The south-eastern slope, for nearly its entire length of over two hundred miles, has undergone very extensive denudation; the phenomenon of scratching and polishing prevails almost everywhere over its surface; the striæ are remarkably distinct in many places. Point Pleasant and Leahyville, near Halifax, are examples. When the drift or boulder clay is removed, the scratches and furrows are frequently met with, and they are generally in the same direction; yet, there are some places where the striæ, or markings, exhibit different courses. Near Morgan's, on the LaHave river, the course is S. 63 W., whilst in a valley about five miles east, the course is quite different, being nearly north and south.

The direction of the strike of the gold-bearing rocks is generally very regular, and nearly at right angles to that of the glacial groovings, the former being nearly east and west, whilst the latter is north and south. Subjoined I give the general direction of the strike of the slates in our principal gold mining districts, with as many notes of the courses of the striations as I am able to place before you:

	Course of Strike.		Course of Striæ.	Year when taken.
1. Goldenville, nearly	E. and W...	.....	N. and S...	.....
2. 15-mile Stream	S. 80, E.....	.....	S. 10, W.....	1868
3. Beaver Dam	S. 57, 30, E	.....	S. 5, W.....	1871
4. Tangier	E. and W..	.....	S. 20, W.....	.....
5. Carriboo Moose River	N. 87, E.....	.....	.....	1876
6. do. Lindsay Lake	N. 75, E.....	.....	.....	1881
7. do. Musquodoboit	N. 74, E.....	.....	.....	1864
8. Gay's River (conglomerate)	N. 78, 25, E.	.....	N. and S.....	.....
9. Lake Catcha	N. 72, E....	.....	.....	1882
10. Chezzetcook	N. 75, E.....	.....	.....	.....
11. Lawrencetown	S. 87, E.....	.....	.....	1862
12. Waverly	N. 81, E.....	(Exposure near W. Junction)...	S. 5, E.....	1865
13. Oldham	N. 82, E....	.....	N. 10, E.....	1862

The direction of the strike and the year when taken, were obtained through Mr. Carman of the Public Works and Mines Office. Some of the courses of the striæ were taken by myself, others by parties to whom I have applied in the present year. The bearing is magnetic.

The unmistakable traces which are so marked shew that vast glaciers must have once existed here, or, that these markings are due, as Dr. Dawson in his Acadian Geology seems to favour, to the abrasion of the rocks by icebergs coming from the direction of the sea. We have the carefully prepared and almost conclusive reasons given by Dr. Dawson on the glaciers and icebergs of the Post Pliocene period, published in 1868; but we have other authority on glacier action by equally active observers, such as Professor Tyndall and others. In examining the evidences which are illustrated by markings or striation running in the same general direction in Nova Scotia, and other phenomena which they suggest, it is not easy to assume any definite conclusion respecting this theory or that. Whilst quoting such authority let us approach this subject gradually.

Professor Tyndall, after discussing snow-crystals and regelation in his work "Heat as a mode of motion," discourses from actual observations of his own among the Alps, as well as from the records of other writers on the glacial action now going on in the Himalayas, the Andes and many other snow-laden mountains; and propounds the theory that the scars, flutings and furrowings

visible along the valley of the Rhone for a distance of 80 miles. until lost in Lake Geneva, are due to the same cause. For, says the learned Doctor, " Grand as the present glaciers seem to those who explore them to their full extent, they are mere pigmies in comparison with their predecessors." By their predecessors he means, as expressed previously, traces of ancient glaciers.

There are many theories for the cause of glacier motion.

1. That of Dr. Saussure,—The slow but continual sliding of the icy masses on inclined bases.

2. The dilation theory, from expansion of water accumulating daily in its fissures, tending to urge the glacier onwards.

3. Then there is that of Professor Forbes, viz :—A glacier is an imperfect fluid or viscous body which is urged down slopes of a certain inclination by the mutual pressure of its parts.

The Encyclopedia Britannica, after giving in its usual precisive style, a description of the glacier, concludes its last paragraph on the subject thus :—" The problems of the cause of glacier motion cannot yet be considered to be satisfactorily solved," and goes on to quote the contributors on the subject, such as Professor James Thompson, Professor Forbes, Sir William Thomson, Tyndall, Faraday and others, ending with the views of Dr. Croll, who regards the motion of ice of a glacier as molecular, resulting from the very conduction of heat through the mass of the glacier, which will melt the ice and create a wave of thaw, but will in turn freeze again and cause a downward movement in the direction which has the least resistance, and the direction in which gravitation co-operates.

If we take a broad view of the extent of surface which exhibits such markings as those under consideration, we can scarcely admit the theory of a gradual subsidence and the re-elevation with the action of the sea and its currents bearing ice at certain seasons of the year, which is really that of Dr. Dawson.

The slope running back from the south-eastern shore to the top of the ridge of the low mountain range all the way from Cape Canso to Cape Sable, although rugged, undulatory and serrated, in numerous places, is nevertheless free from very high protuberances.

A large extent of its surface is so much denuded of drift that any extensive forest fire burns up all the clothing on patches of its surface, leaving the rocks so bare that the miner is invariably tempted to prosecute a search.

The presence of granite patches here and there at the existing surface, shewing that the denudation had reached so far, and the evidences of a granite nucleus in the higher ridge outcropping in like manner, shews that most of the strata under which the granite was consolidated have been reduced to a mere shell by denudation, a work which we could scarcely attribute to depletion by icebergs alone.

And again, the markings are mostly flutings or furrowings, and the mechanical action which caused them can be more reasonably attributed to a slow grinding process than to the force of impact by icebergs, which would exhibit more denticulated or notched abrasion.

The nature and extent of the work performed in excavating and removing a depth of rock surface probably greater in height than some of our present mountains, and extending over two hundred miles in length, could, to our senses, be more reasonably assigned to the agencies exerted in the glacial period or ice age, than any other we can conceive. If we assume a uniformity of action, and adopt the assumption that the whole slope of our Atlantic sea board was being sculptured or shorn at one and the same time by glaciers moving from the north, we can comprehend, to some extent, the cause of the glacial markings. The theory of Dr. Honeyman, of the drift from the north, is the only one that will truly reconcile us to the great effect produced. If denudation other than that of glaciers contributed to reduce the rock surfaces now visible above the sea level, they must have exerted their influence before the Post Pliocene period. The flutings, as I would call them, are, no doubt, the work of large superimposed masses moving slowly; and these traces are on the floor, on the surface of our rocks only,—they have not been observed lower, so far as I can ascertain.

If we carefully observe the fluted-like etchings visible on the rock surfaces of Nova Scotia, with the view of determining for

ourselves whether these markings were caused by a slow grinding process, or by the abrasion of icebergs striking, rocking or slipping on an inclined rock surface, we will, I have no doubt, conclude that the former, viz, the slow grinding process, was the much more likely to produce them.

If we judge from effect, there is no reason whatever that Dr. Honeyman's theory, which is, also, I believe, that of Sir William Logan and Professor Hind, that larger masses of ice moving in glacial form over the surface, and carrying with it pebbles and boulders, is not the correct one to assign to the work performed. There are so many evidences which tend to establish it, both from a mechanical and theoretical point of view, that it would be superfluous here to mention them. They are plainly given in Dana's text-book of American geology, as well as by Professor Tyndall and other writers, who have made the subject a study.

We cannot, however, stop here: there are other features to be accounted for; they are, viz:—The old sea beaches and a local drift, which must have occurred at a more recent period. For, if these beaches then existed, and also the local drift, which I shall hereafter more particularly refer to, any glacial movement must have carried them with it, and deposited them elsewhere in a much more irregular manner than their present appearances would indicate.

I have been considering this matter, and give some notes on the subject for what they are worth.

Every practical miner in our gold fields knows (for every miner in Nova Scotia is also a prospector or searcher for paying-quartz leads on its surface), that if he finds a boulder shewing gold, he will invariably look for the lead or quartz vein to the north of where he finds it, so sure is he of finding the lead to correspond in width and richness as is indicated by the boulder, and that he will exhaust, probably, all his means in the search, or succeed in the find. The direction in which to prosecute the search and the distance, which will vary generally, according to the depth of the drift, is so well understood as to become proverbial.

The quartz boulders are not at all weather-worn, their edges

being just as sharp as when broken from the vein or lead (as it is called) to which they belonged.

Let us reject the assumption that the gravel ridges remaining on the top and slopes of the South Mountain are old sea beaches, and for the present call them Moraines, and inquire only into the first postulate, by asking the question: Assuming that there was a glacial movement over the surface of our south-eastern slope, cutting the rocks by a shearing force and carrying them with it, how can we account for the more local movement of the quartz boulders?

These boulders appear on the surface; they may have been broken from their beds by agents such as are now active, viz: the alternating influence of frost and heat.

I know that the frosts of winter will keep boulders on the surface, although they may be again and again covered by silt. I can account for the lifting by the process of freezing. If we could, in this same way, account for the travelling in a southerly direction, which is not so improbable, we might solve the problem of the local drift.

The fact of the distance from the lead being dependent upon the depth of the drift, favors an assumption that in the process of lifting there was also a travelling movement.

It has been remarked to me by very practical observers and searchers, such as Mr. John Anderson, of Musquodoboit Harbour, and Mr. Fraser, M. P. P. for Guysborough County, that miners observe, when costeaning from the boulder northerly, to look for the lead, they frequently find traces of quartz of the same kind, from the boulder on the surface to the lead *in situ*, graduating from one to the other. This fact would go to shew that the upward movement was gradual, and it would not be a great stretch of imagination to assume that, as the boulder was lifted by the process of freezing, it would be forced somewhat in the line of least resistance—i. e., if it was frozen a little firmer on the north side, it might cause a movement southerly. If these facts were more carefully looked into, the local drift might be accounted for.

My greatest trouble is the old sea beaches. I cannot assign

their existence to originate from Moraines, because they appear to be of similar constitution to our sea beaches of to-day.

In a paper read by Mr. Gilpin, Government Inspector of Mines for this Province, before the North of England Institute of Mining and Mechanical Engineers, he says:—"There seems to have been two periods of attrition and transportation. The effects of the earlier are now visible in immense "boar's backs" from 50 to 150 feet in height and sometimes a mile in length, following a general north and south course;" and again he says: "A second and more local action is also visible, and by its agency the auriferious veins are usually found. This action has carried the quartzite and slate boulder from 100 to 1800 feet, on a course corresponding very nearly to that of the striæ. Thus prospectors finding auriferous quartz boulders, costean to the North, and frequently trace the boulders to lodes corresponding in every respect to the boulders first found."

If our surface, as is shewn by research, has undergone great and remarkable vicissitudes during geological history, with alternating epochs of genial temperature and snow and ice, the striation and polishing of our rock surfaces may have been effected by glacial action; and subsequently another, and less destructive movement of the same nature, may have taken place which might account for the local drift according to the theory of Mr. Gilpin.

1. GEOLOGICAL.

Commencing at the shore of the Bay of Fundy, we first encounter a thick bed of Amygdaloidal trap, varying in colour from gray to a dull red. It is full of cavities and fissures filled or coated with quartz and other associated minerals. It forms the face of a cliff and rises vertically to a height of 110 feet, and from thence rises gradually with its associated slates and schists, until it attains a height of 595 feet in a distance of three miles; from thence it descends to the Annapolis valley, 345 feet below the summit, within the distance of a mile.

We have now crossed the North Mountain, a narrow ridge not more than four miles wide at its base, and attaining a height of nearly 600 feet, and have reached the Annapolis Valley, which from here to the Village of Nictaux, a distance of 7 miles, is of

regular surface, and covered with drift. This latter distance is said to be Trias, or New Red Sandstone, but we could not, within the limit of our observations notice any outcrop which shews sandstone rock *in situ.*

The iron ore bearing strata of the south side of the Annapolis Valley, which are first met at Nictaux, have been described by Dawson as Devonian, but Dr. Honeyman, from recent explorations, is inclined to place them much lower. I am able to place before you some fossils taken from the iron deposits themselves at this place, which may assist in determining the age of the strata here. The slate here has a strike of 45° E. and dips N. 85° and continues up the valley of the Nictaux River to the 15th mile. At the 13th, and again at the 13½ miles the outcrops of some of the Cleveland Magnetic Lodes present themselves. Two at the 13th mile, 5 to 8 feet thick, each are said to be very rich. They run N. E. and S. W. across the line of the mountain-range with a slight northerly dip, and were only two of many which the Cleveland Iron Company have opened up by prospecting. At 14½ miles Smith's Bluff is reached, where the formation changes from slate to granite. Here we encounter a solid bluff of the latter, but for a short distance only. We are now in the granite region. From here to the crossing of the LaHave River, a distance of 28 miles, any visible outcrop met with shews "porphyritic granite."

Immediately upon crossing the LaHave river, at the 43rd mile, there is a transition from granite to slate, which is seen in the beds of the various streams, and in the gravel round Wentzell's lake. The strata has a strike of south, 60° W., and dips northerly at an angle of 80°, the cleavage being nearly vertical.

We are now in the Lower Cambrian formation, or the auriferous region. At 47 miles, at Morgan's falls, the strike is north 63° E., the dip is northerly 87°. At Riversdale, 49 miles, the strike is N., 60° E., dip 87°, N. At 60 miles the strike is N., 65° E., the dip is vertical. At 61 miles we lose the slate in our line of survey, drift, with granite boulders, taking its place, which continues to Bridgewater.

Local Topography.—Bay of Fundy to Atlantic, through Nictaux.

I give the local topography along the line of survey in the words of my report made in the year 1875:

Commencing at the Middleton station, on the Windsor and Annapolis railway, it crosses new pasture land, tillage, orchard, meadow, orchard again, and choice intervale to Annapolis river; thence to Nictaux village, clearings, light alluvial pastures, three orchards, and some spurs of spruce woods. For this distance of four miles throughout, the soil is alluvial and mellow, famous for its great natural fertility, as is all the Annapolis Valley, by producing in abundance most of the grain and fruits belonging to its latitude.

From here the line begins to ascend the western slope of the hill-side of the Nictaux river. Keeping an inclining contour, no serious depression or ravine obstructs the course, which is over an apparently good surface, with occasional outcrops of slate. A mixed growth of heavy timber,—beech, birch, elm, pine, spruce and hemlock—clothes the hillside.

From 6 to 7½ miles, still keeping the same inclination, and following in like manner the contour of hill-side, the same heavy and mixed growth of timber and surface is passed. Here Smith's Bluff is reached, thence to 8.18 miles, where it crosses the Nictaux river, the surface is rough; burnt woods, with some patches of timber still standing, intervene.

From 8½ to 9½ miles, still keeping on the east bank of the river, and still inclining upwards with the same grade, very heavy timber, consisting of hemlock, spruce and hardwood, is passed, as well as some choice farming lands. At the 10th mile we reach the mill-dam of Messrs. Pope, Vose & Co., and from here to 11 miles the surface is denuded of soil by forest fires, and any timber met with is stunted and scrubby.

From 10½ to 12¾ miles, the surface is rough and barren, covered by granite boulders, recent forest fires having destroyed all vegetation; thence to the 14th mile we cross over beautiful intervale soil clothed with heavy hardwood, spruce, and hemlock.

Somewhat similar surface and mixed growth of fine timber continues to the head of Waterloo Lake, which we skirt on the east side. From the head of Waterloo Lake, crossing the Halifax road, we soon reach the clearing or pasture land of Mr. John Stoddart, where we attain the summit of the watershed or highest elevation, tract of intervale land growing fine black ash timber.

For the next mile the trial line traverses a meadow, mostly spongy and arid, but with intervening patches of good pasture. At 24 miles, we reach Freeman's Lake, and skirting along its west side, we pass some of the beautiful pasture lands of Springfield, which encircle this lake. From here for 1½ miles, we pass through rocky, barren soil, with a growth of scrubby timber, to Falkland Ridge Road which we cross at 250 feet to the right of the bridge across Beaver Brook. From here to the foot of Mill Lake the surface is principally pasture, with occasional clumps of heavy hemlock. The line here is about midway between the farming districts of Falkland Ridge and Lake Pleasant; the former two miles to the left, the latter the same distance to the right. The soil along the lake is free from rock and well adapted for agricultural purposes, as is manifest by the numerous thriving farms in the neighborhood; thence to the outlet of Mill Lake a belt of soft wood is traversed. At 29 miles we cross the Lunenburg Road and follow the contour of the east side of an open hardwood ridge, sloping steeply towards Mason's Meadow. Soil on this hillside is a light rich loam; the hardwood is, however, soon supplanted by a growth of hemlock and spruce; and the surfaces changes to rough, rocky ledges, until the level of the meadow is reached at 33½ miles. From here to 35 miles sandstone boulders are met for the first time, drifted together with granite and the eastern side of a barren, thence to the crossing of the LaHave River, at 36 miles, we pass through some good timber lands of mixed varieties, and reach a meadow which extends to the bank of the river.

From here we follow the river and public highway along the east banks of Germany Lake, diverging somewhat at Chesley's. From thence to Bridgewater, a distance of 16 miles, the line follows respectively the road and the river; both are in close proximity, the surface regular throughout.

The general character of the surface for the last 16 miles is that of a long, rich agricultural valley, bounded on each side by a continuous line of hills of various forms and surfaces. The timber is heavy, pine is frequently met with; but the growth principally varies with the varied surface of the land.

The country, so far, sketched along the line of survey, ought to be understood as being local. There are many thriving settlements and farms, not mentioned here, lying in close proximity.

DRAINAGE.

The southern promontory of Nova Scotia lying west of the 64° of longitude, embracing the counties of King's, Annapolis, Digby and Yarmouth, on the north and west, and those of Shelburne, Queen's and Lunenburg, on the south and east, are very marked both as to typography and drainage, extending in a south-westerly direction beyond the 66°, between the Bay of Fundy and the Atlantic Ocean. The South Mountain range of elevated land extending from the Basin of Minas to near Annapolis Royal, in the same south-westerly direction, and from thence converging more southerly through the County of Digby, forms the grand features of the country and regulates its drainage, disposing of its surface water from the northern slopes through the rivers Annapolis, and Cornwallis, which run respectively south-west and north-east to the Basins of Annapolis and Minas.

The Windsor and Annapolis railway found an easy location along these rivers, which traverse the two beautiful alluvial valleys of Cornwallis and Annapolis, famous for their natural fertility.

The physical features of the country south of the South Mountain, are very different to those described on the north side. Instead of the rivers receiving the drainage and running laterally with them, they run at right angles to them, and course nearly parallel to each other. Such are the Gold River, LaHave, Port Medway, Liverpool and Jordan rivers.

The summit of the water-shed is crossed between the Nictaux and LaHave rivers; these rivers here interlace and cross each other in a series of lakes lying in an extensive plateau.

Topography along Annapolis and Liverpool Line of Survey.

We started from the Annapolis and Yarmouth "Interior survey" at a point distant from Annapolis 11¾ miles near Quarry Road, on the east side of East Branch, Moose River. The line follows the course of the stream to the Hessian line road, which it crosses at one hundred and twenty-nine feet east from the bridge. Thence keeping the east side of the stream, and gradually ascending the side hill, with a grade of one in ninety, or 58·7 feet per mile, till it reaches Lake Katy, where it crosses the river at the outlet from lake. Continuing along the east side of Lake Katy to near Virginia Settlement, it crosses the road bearing that name and thence follows the general course of that road till it arrives at Mud Lake, crossing the head of same and thence running direct to the lake known as "Head Waters of Liverpool River." Having arrived at the "Liverpool Head," we were then on the southerly slope of South Mountain, and on the water shed of Liverpool River.

The distance of this summit from Liverpool, in an air line, is nearly fifty-five miles, and the elevation five hundred and sixty feet above the sea. Keeping the west side of lake, crossing Sandy-bottom Brook and Virginia Road, running along the south of the latter for one-fourth mile, recrossing the same, and keeping its north side to Liverpool and Annapolis post-road at Milford, following the road through Milford Settlement; thence along the western side of Long Lake, keeping the general course of post-road, and following the western side of Branch Lake, and the same side of Maitland River to Five Mile Lake, and from here along the western side of Liverpool River we arrive at Millford.

The slopes of the adjoining hills are well covered with heavy timber, pine, spruce, hemlock, and hardwood.

Leaving Caledonia, the line crosses the course of the lake, near the post road, Mr. Moor's farm road and the "narrows" of McLeod's Lake, keeping the valley along same, crossing Smith's mill brook and entering a meadow, distant from Brookfield one half mile.

Leaving Brookfield and taking a south-easterly course, the line

crosses Payzant's and Cameron's farm roads, runs close to Christopher's Lake, and crosses Cameron's river, at up-stream side of bridge on main post-road, between it and Bear Trap Lake to a stream bearing the same name, following the westward side of lake to the 45th mile, thence to the western side of Moose Horn Lake, crossing Seventeen Mile Brook at about one half mile from main road, striking Greenfield and Sixteen Mile Settlement road, about two miles from Greenfield.

Thence the course taken continues across Fifteen Mile Brook and through Allen Morton's pasture, about one-fourth mile from Middlefield, meeting the new Greenfield road at a distance of 150 feet from the main road, and taking the east side of the latter to Ten Mile Brook, which it crosses at one hundred and twenty feet from the bridge on post road; again crossing this road, it strikes the eastern side of Ten Mile Lake.

Most of the ground over which the survey passes in this distance of fifteen miles is almost denuded of alluvial surface.

Continuing along the east of Ten Mile Lake, and the west side Liverpool and Annapolis road, the line crosses the Liverpool River road at three hundred feet from its junction with the main post road; thence running for and keeping the east side of Liverpool River to Milton. This distance of ten miles is through a well-wooded but thinly-settled country.

Milton, two miles from Liverpool, although having distinct characteristics from the latter, may be considered as an extension of that town, and, judging from the appearance presented by its buildings, as well as the extent and resources of the mill privileges more or less made available for the manufacture of lumber, it is not the less important. The Liverpool River here, for a distance of nearly two miles, is a series of small lakes or pools, impounded by mill dams, and made to pay easy tribute of its strength on its journey.

The mechanical force thus stored and so aptly utilized by the predecessors of the present generation, for the manufacture and export of Lumber, proved so remunerative that comfortable homesteads, nestling in shady nooks, half embowered by trees and sombre woods, remain as a transcendant example of the fruits of industry, skill and perseverance.

SOUTHERLY SLOPE—SOUTH MOUNTAIN.

If we were to follow a course along the South-eastern or Atlantic slope of the South Mountain, keeping parallel with the trend of its summit and lower than the granitic outcrops, we would traverse a district of much interest which is known to few, and would find many places obscure and lonely, possessing great natural beauty and fertility. Along the southernmost slope, this belt, varying from ten to fifteen miles in width, is reticulated by many green patches of foliage and luxuriant growth of timber, exhibiting remarkable contrast with the barren denuded surface of a great portion of the country further down. If you would follow this varied yet regular range of landscape, alternating with lake and woodland, many strange phases of primitive grandeur would present themselves. Some noble forest trees of vigorous growth, some far gone in years, some shattered by the winds and frosts, bent and broken, lying athwart their neighbours, others long since departed yet still bolt upright with their bare white rampike branches atop, and here and there small clumps of new growth shewing all the beauty and vigour of youth. Further on is the "hardwood hill," with its stately white limbed birchen or maple, shewing smooth firm trunks and wide protection of bough, as regular and as trim as if pruned and trained by the expert to beautify some lawn or avenue in the frequented and ornamental parks of Europe. Rising from a carpeted floor of crisp leaves, at remarkably regular distances apart for their convenience of growth and development, these trees, indigenous, clothe receding hill sides for many miles. We notice that the lines are somewhat finely drawn between the domain of each of its kind, each generally keeping within its own boundary. There are, of course, many intervening patches of a mixed growth of pine, birch, maple and others, yet generally speaking, the first named three keep within the zones of their kind. Long vales of meadow, with a copious covering of grasses, frequently are met with. They generally encompass lakes, or border streams on alluvial or peaty surface, and often open up glades that permit the eye to range over a prospect beautiful and extensive. Rosignol, with its clustered islands, secluded

and solitary, the largest of our inland lakes, is exceedingly pleasing and picturesque—here expanding into a broad sheet of limpid glow, there presenting narrow wavy outlines in the sombre shadows of islands that look as if afloat, and bearing mast like the spruce and hemlock which give them a trim and characteristic appearance; and again we come unawares on long winding armlets branching and converging with fringed borders of willow and alder, that dip their pendant branches into the water, all giving a semblance of vastness to this natural landscape scenery, that when once seen is not easily forgotten.

The Mic-Mac has for ages established this secluded retreat, commonly known as the Indian Gardens, as the centre of his hunting operations. Here in summer he can provide himself with fish, and in winter he is in the path of the Moose or Elk, that still roam at large and almost unmolested over the vast tract of wilderness. The Beaver, too, is still active in the lakes and swamps along this district, and although his domain, like that of the Moose, is fast becoming circumscribed, he yet furnishes some winter sport and employment to the hunter and trapper.

ART. IX.—NOTES ON NOVA SCOTIA FRESH-WATER SPONGES.

BY A. H. MACKAY, B. A., B. SC.

(Read 12th May, 1884.)

About the middle of August, 1883, I spent a few hours examining the MacIntosh Lake, near the north-eastern extremity of the Cobequid range, and the Earltown Lakes, a little higher up on the same range, with the object of learning the nature of the deposits at their bottoms. Having extemporized a small raft on the former lake, I paddled out a little distance, and with my face close to the water, saw old branches of trees in the bottom, with patches of a thick green growth surrounding portions of them, sometimes bearing short finger-like projections. Drawing these up, I made my first practical acquaintance with a fresh-water sponge. On the hard, gravelly beach of a small

island in the centre of the lake, I found green sponges branching out four or five inches. The external configuration of this sponge was sufficient to point it out as *Spongilla lacustroides*, Potts, the American form of the European *S. lacustris*, which it much resembles. The deposit in the lake was chiefly composed of the exquisitely sculptured silicious cells of over fifty different species of diatoms to which I shall specially refer in another paper, mingled with a great number of the skeletal and other spicules of more than one species of silicious sponge. Among the plants of the higher orders the waters had an abundant supply of Potamogeton, namely, *P. natans* L. and *Var. prolixus* Koch., *P. praelongus*, Wulfen, and *P. obtusifolius*, Mertens and Koch., and *Naias flexlis*, Rostk, of the same family, and of the Gentian family, *Limnanthemŭm lacŭnosŭm*, Grisebach, with its floating, heart-shaped leaves, while *eriocaulou septangulare* Withering, and *Lobelia Dortmana*, L., studded the shallows. In the Earltown lakes the following were, in addition, plentifully found: *Ranŭnculus aquatiliso*, Var., *trichophyllus*, Chaix, and *Chara fragilis*. Also, near by, in a pond just below McKay's mills, a luxuriant mass of *Nitella flexilis* was found. The altitude of this position will be probably not very far from 1000 feet above the sea level. Mackintosh Lake, which is a little lower, and on the north-eastern side of the water shed, is most easily accessible from Pictou County, near the boundary of which it is situated, a few miles above Loganville, on the West Branch of River John, yet in the County of Colchester. The waters of both lakes are very clear, and the drift around the Mackintosh especially, is characterized by the presence of granite.

I have had but little time to follow out the collection and study of the sponges since the accidental discovery alluded to. I shall therefore throw this paper into the form of notes, or of a report of progress, hoping to be able to give more complete information by the end of another year. I shall now simply describe the freshwater sponge as a mass of reticulated or channelled sarcode, green, when exposed to the influence of the light, supported by a framework of interlaced silicious spicules,

about the one hundredth or 12 one thousandths of an inch in length. (See slides, Nos. 2, 3, 5, &c.) In the sarcode is another system of smaller generally cured and tuberculated spicules, averaging from $2\frac{3}{4}$ to 3 one thousandths of an inch. (See Nos. 1, &c.) And thirdly, we have in the statoblasts or reproductive gerumules which are generally formed towards the close of the summer season in the body of the sponge, what are called the *statoblast spicules*, smaller than the others, forming the best basis for classification. I have sent specimens of the material collected to H. J. Carter, Esq., F. R. S., of England, the author of the "History and Classification of the known species of Spongilla," the latest and most authoritative monograph on the subject. Mr. Carter kindly assisted, and sent me specimens of some English and American forms. The following is a summary of what is already known:—

Spongilla lacustroides, Potts.—This species I have found growing abundantly in the Mackintosh and Earltown lakes. It probably also exists in the water supply lakes of Halifax, judging from the appearance of some of the skeletal spicules in their deposits received through the kindness of Professor George Lawson, of Dalhousie College. There is a great rarity of statoblast spicules in the lake deposits examined. This will not be so surprising when it is considered that in the specimens of spongilla collected in August last, of which some dried fragments are here for examination, when treated with acid to destroy the organic matter, only skeletal and flesh spicules are to be seen, as in slides Nos. 1 and 2. Slide No. 5 shows the spicules, all three kinds, of *S. lacustris* from the Exeter River, England, obtained from a portion of a specimen sent me by Mr. Carter. The statoblast spicules are few, more curved, broader than, and not tapering like, the flesh spicules. The corresponding ones of *S. lacustroides* would be less curved. On slide No. 3 are shown the spicules of another species in addition to the first named, which I was suspecting to be those of *S. fluviatilis* from the large tuberculated skeleton spines, and the impression that they had come from a large though not branching sponge which, from the unexpected

character of the discovery, I had unwittingly mixed up with *S. lacustroides*. However, I discovered none of its stellbate birotules, and neither Mr. Carter nor Mr. Potts, of Philadelphia, have observed any evidence of the existence of this species in lacustrine deposits sent them.

Meyenia Leidii, Carter.—Slide No. 10 contains the skeletal, flesh and small birotulate statoblast spicules obtained by the acid treatment from this sponge which comes from the Schuylkill, Philadelphia. A few birotules like this have been observed in the lake deposits, from which the presence of the species is inferred. I have not been fortunate in securing one in any of my mounts.

Meyenia crateriforma.—Slide No. 12 shows the spicules of this species, the large hooked birotules being in great numbers. This also comes from the Schuylkill. A few birotules like these have also been observed in the deposits alluded to, but so rare that none happen to be in any of my mounts.

Meyenia Everetti, Mills.—Birotulate spicules, identical with those of this species, are found one in each mount on an average in the Halifax Water Lake deposits, which I received from Professor Lawson. Slide No. 15 contains *one* if not two near the right hand lower margin of the cover. It is smaller than the birotule of *M. crateriforma*, with the shaft quite smooth.

Slide No. 84 contains 14 skeletal spicules of the most common form from Earltown lakes, arranged in the two lower lines of the lower right hand rectangle. Accompanying the slides which explain themselves is a small box with dried portions of *S. lacustroides* and some of the fresh water deposits from both Mackintosh lake and the Earltown lake. The amount of silica derived from these waters and formed into diatom cells and sponge spicules must be very great, as the deposits are in some places very many feet in depth.

NOTE.—Since the above paper was presented, the author has observed *nine* species of freshwater sponges, (*four* genera) living in the lakes of Nova Scotia. Of these, two, viz., *Spongilla MacKayii*, Carter, and *Heteromeyenia Pictovensis*, Potts, are new to science. They will appear in next year's Transactions.

APPENDIX.

Report by Wm. Gossip, Esq., Delegate to the Royal Society at Ottawa, May, 1883.

(Read Nov. 12, 1883.)

At the Quarterly Ordinary Meeting in April, 1883, of the Nova Scotian Institute of Natural Science, I was chosen a delegate to represent the Institute at the meeting of the Royal Society of Canada, with which we had become affiliated, and which was appointed to be held at Ottawa in the following May. It was a pleasure to me to be the recipient of, and to accept the honor and responsibility; and as a natural sequence it appears that I am expected to furnish some account thereof, so far as my observation extended. I should very much have wished, that what I had to say were of far greater interest; and the only credit I take in the matter is, that it may help to wile away the time in the absence of important papers on subjects of a more scientific nature.

It is certainly a long journey between Halifax, the capital of Nova Scotia, and Ottawa, the Capital of the Dominion, our Institute being the most remote eastwardly of the affiliated Societies. I had never visited the Metropolis, and this was no doubt a chief inducement to undertake it, as it afforded a favorable opportunity of doing the nine hundred and odd miles that intervened. To encourage hesitating travellers, I may state that the journey proved very pleasant at this season, the weather generally delightful, and growing gradually into comfortable summer warmth; and I may also mention, that so far as railway mishaps are concerned, we met with none, and that nothing

occurred to mar the pleasure of the excursion, or is likely to occur on any similar occasion, so far at least as careful management of the Intercolonial is implicated.

Professor Allison, Superintendent of Education, and delegate of the Nova Scotia Historical Society, and Professor MacGregor, of Dalhousie College, a member of the Royal Society, and of our Institute, were fellow travellers with myself from Halifax, and a delegate from New Brunswick, on the same errand, met us at Moncton. There was very little railway detention at any of the stations, and we realized a decided improvement since former visits in this direction, at the stations where provision and attendance are furnished,* the quantity and quality of which minister so largely to the comfort and convenience of locomotion.

There is a marked difference in the length and severity of the winter between the Atlantic coast of Nova Scotia and those parts of New Brunswick and Quebec through which we had now to pass. We left no snow behind us, either at Halifax or Truro, and cultivation was fairly progressive, onward and past Amherst to Moncton. But although this was well toward the end of May, the snow had not entirely disappeared further along the route, and very few signs of progressive vegetation were to be seen. On the hills around, here and there, and often in secluded places on the railway level, were large patches of snow, first seen at Coal Branch, N. B., most frequent from Campbellton on the Restigouche, and onward on the Metapedia, an affluent of the Restigouche, which, spreading into a large lake-like expanse, still retained its winter covering of ice, although evidently on the point of breaking up. The ice was all gone on our return, eight days later.

We get no more than a passing glimpse of the small townships, or villages, which follow each other in rapid succession on the railway route by the lower St. Lawrence, on to Chaudiere Junction, near to Point Levi. Rimouski, a summer port of the Allan steamship line, is apparently the largest and most important. What can be seen by the railway traveller does not exhibit signs of any modern improvement except the railway itself. The

* Except at Chaudiere Junction.

approaches to some of the stations are picturesque and of much natural beauty. On the sea side is the Gulf, at this season a sombre, sailless, vast expanse of open water. On the land side the ground presents a bare, uncultivated appearance, with a few sheep and cattle grazing, where a human being at this season is a rare appearance. At the stations the scene changes. There the arrival of a train is still an important event, and excites curiosity and talkativeness. The language is French *patois*. The people around the stations are all seeming idlers and French labourers and artizans. The village dwellings look comfortable, but without any pretensions to architectural neatness or design. A further acquaintance might, however, develope something better worth looking at than tavern and other signs and insignia. Almost every station bears the name of a saint, who, from appearances around, does not seem to care much for the growth or prosperity of the place after which he or she is named. To use an expressive and homely Scotch phrase, these holy patrons appear to "have ta'en a scunner" at the whole region. There is, however, a large bid all along the Lower St. Lawrence, in spite of apparent neglect, for saintly protection and intercession in mundane concerns.

On arriving at Chaudiere Junction, near Quebec, the Intercolonial ends, and the Grand Trunk monopolizes passengers and freight onwards, to the serious detriment of our railway line. We arrive at Montreal early Sunday morning, and express some astonishment that so far the attendance of members and delegates from the Lower Provinces is so scant. The day was remarkably hot, and the morning was spent in leisurely visiting Notre Dame, the Quays, and other remarkable localities. In the afternoon Prof. MacGregor, our New Brunswick friend and myself strolled up the mountain to McGill University, or College—the latter being its more popular and familiar appellation. It occupies a conspicuous site, and is a cluster of detached buildings, about which exteriorly there is nothing remarkable, either in architectural design or beauty. The Principal was away at Ottawa. After satisfying, so far as was possible, our curiosity, we climbed the steep stairs back of the house and grounds which formed the

handsome residence of the late Sir Hugh Allan, who gave to Canada the noble line of steamships that bear his name, passed on above the reservoirs that regulate the water supply of the city, ascending in this way to the summit of the mountain, from which spreads in every direction the most enchanting and extensive view of the country around. At our feet in Sunday quietude and silence lay the City of Montreal, every tower and spire (Notre Dame conspicuous) easily distinguishable. Next the noble river with its wealth of shipping at the quays, the Victoria Bridge, its chief feature,—and then the country beyond and around on all sides, studded with villages and farms—the whole embracing a circumference of fifty miles or more. There were not many on this hot day who had achieved so elevated a position—but the scene well repaid the exertion. The mountain with its palatial residences, religious houses, and sylvan scenery, presents of itself a richly picturesque appearance. At this height and so early in the season, indicatory of the rapidity with which spring or summer succeeds the intensity of winter's cold around Montreal, the ground was covered with quite a luxuriant growth of herbaceous plants and wild flowers in full bloom and rare beauty, not having, so far as we are aware, their counterpart in Nova Scotia (of which our New Brunswick botanical friend took particular notice), completing the beauty of the glorious prospect. We could have remained for hours in admiration of the lovely panorama, and its natural and artificial beauties, but a gathering rain obliged a reluctant retreat, and highly delighted as we had been, we descended the mountain, but at a much more rapid pace than we had taken to gain the summit, somewhat tired withal, and glad to arrive as quickly as possible at the shelter of our hotel.

The train left for Ottawa, 120 miles, on Monday morning, which was reached by 12 noon. The country everywhere had thrown off its winter garb. There were no lingering patches of ice or snow. Wild flowers, skirting the track, met us at intervals, this time of a bright yellow colour, clustering like primroses. Our friend, the sole New Brunswick botanical delegate, spoke of them as not being indigenous either in that Province or Nova

Scotia. Certainly the season here is at least a full fortnight in advance of all the country between Montreal and the Lower Provinces. The villages from St. Polycarp onward, were quite a contrast in beneficence of their saints, to those on the Gulf shore below Quebec, more picturesque and prosperous, especially in the vicinity of streams, the characteristics of each decidedly Canadian, but becoming more and more of a British type, the nigher we approached the metropolis—the land low and the soil rich. Lumber was apparently the prevailing mercantile commodity, and numerous piles attested its value. An hour improved appearances in every respect. We came in view of the noble Ottawa, much pleased with the morning's ride, and prepared for a closer acquaintance with the Metropolis.

Ottawa is a city of magnificent distances, a fact easily realized in passing from the railway terminus to the hotel. Many of the streets seemed to be more than a mile in length, crossing at right angles, wide and spacious. It is to be hoped they are all sufficiently high above the river to prevent danger from floods. The Parliament Buildings, erected on a gentle elevation, imposing in the style of their architecture, are conspicuous objects, in every way creditable to the youthful energy and ambition of the Dominion, and crown the city with an air of regal splendor. Ottawa is a Capital of large pretensions, the site and plan being chosen and approved by Her Majesty Queen Victoria, as a central position in a beautiful country, removed from the American frontier, and easily defended in the event of war. Rideau Hall, at the distance of a mile from the Parliament Buildings, the palace of the Governor-General, is quite insignificant in its contrast with the Parliament Buildings, and ought ere long to give place to a structure more in keeping with the Viceroyalty of a Dominion which spans the British American Continent, and east and west is bounded by the Atlantic and Pacific oceans.

No one can be mistaken who visits Ottawa and its environs, as to its principal industrial staple. The immense piles of sawn timber, here, there and everywhere, strike the beholder with amazement. It was remarked by several, as by the writer, that they never saw anything like it. Yet this was not the busy

season, and of what that may be, both on the river and the shore, we could form only a vague conception. Withal an opinion is broached by some residents, not however general, that Ottawa is unlikely ever to become a flourishing Capital. They probably expected a large and sudden development on its assuming that character, or it may be based upon correct and continued observation. As a stranger, however, we could see no reason for it, and in all respects it is unfounded by any comparison with maritime progress. The immensity of the staple, the bustle of business, the din of steam machinery incessantly at work, the cabs and busses continually running to and fro full of passengers, several first-class hotels, the customers frequenting various handsome retail stores contiguous to the parliament houses, large churches of various denominations, the activity everywhere displayed, all tended to disprove the grumbling element.

Ottawa is delightfully situated, but a large area remains to be built upon. Its geological foundation is sure, being the Trenton limestone formation, which, comparatively in the ascending series, is not much above the lowest non-fossiliferous rocks that first solidified into the crust of the globe. The displacements and contortions of thousands of ages, the disruptions and denudations of overlying strata, as numerous periods have passed over them, have made the country what it is, an invaluable legacy, bequeathed to the energies of the most energetic branch of the human family, to perfect the beneficent designs of an Omnipotent Creator. The natural scenery, in a limited circumference, is all that can be desired either for walks or drives. It is more varied than that of our own Halifax, but can hardly be surpassed, which is saying a good deal for its beauty; the sky, at all events, at this season is of a paler blue than with us.

Hull, a township or district on the opposite side of the river, which we did not visit, is crossed to by a ferry, looked pretty in the distance, and is an attractive outskirt of the Capital. At a short walk in another direction are the Falls of the Rideau and the timber slides, inviting to passive courage. Canals, having numerous locks, pierce the city and communicate with the rivers. The extensive machinery which regulates the water

supply, is well worthy a visit. There are also the Parliament Buildings, with the Senate and Commons Chambers, the really splendid Legislative Library, the Museum and the Patent Office, which represents in great and astonishing variety—rather crowded, however,—the inventive genius of the Dominion. In a building in the vicinity, used as a temple of art, some pictures of high merit were recognized, some of which had graced the late exhibition at Halifax, held under the auspices of the Governor-General. Strangers should see all these and everything. In fact there is nothing to disappoint, but enough to gratify curiosity and taste in all the surroundings of Ottawa, which alone of themselves are amply sufficient to make a visit to the Capital of the Dominion highly agreeable.

Ottawa is not gone over in a day; but the remainder of Monday was spent in the gallery of the Commons Chamber of the Parliament, a large, handsome and commodious hall, where the Liberal-Conservative and Grit elements sat facing each other, Sir John and Sir Charles on one side, and confronting them Mr. Blake and his following. Apparently they were seeking explanations one of the other, preparatory to winding up the business of the session, which occupied both parties far into the night. We left long before the adjournment.

On Tuesday the Royal Society met in the Parliament Building to be organized, Dr. Dawson, the President, in the chair. Mr. Bourinot, the Secretary, read the minutes. The President addressed the meeting. The roll was called, and a large number from various parts of the Dominion, members and delegates, answered to their names. The Society was divided into separate sections, which were referred to their several places of meeting. I was consigned to the Natural Science section, which was also where the general business was transacted. Several interesting papers were read, having reference to the Zoology of the North-West. As I was anxious to find anything that would tend to settle the question, whether any two species were common alike to the eastern and western hemispheres, I ventured to ask of the gentlemen who had contributed the papers in which badgers and earthworms were mentioned, if they were of similar species to

the badgers of England and the earthworms of our fields and gardens, and was very kindly informed that the badgers were precisely similar to those of England, with the same habits, only much larger; also that the earthworms were similar to those of our fields and gardens. I remain still in doubt about this latter conclusion. It is certain, I believe, that our anglers never find earthworms in the virgin soil of the woods, but are obliged to take such bait with them. The question may still be one of some zoological importance. A member from New Brunswick laid before the Section a number of well-preserved Indian relics, —axes, chisels, pipes, spear and arrow heads, &c., all stone implements, which had been found in that Province. They were of the Algonkin type of ancient aboriginal relics, and it was presumed were Micmac weapons and utensils. From the absence of pottery in this and other instances noted, it was supposed that the more eastern tribes did not possess the art of making it. Being called upon, I was enabled to contradict this, as in one of the field excursions of the Halifax Institute, with the express object of opening an ancient refuse heap at St. Margaret's Bay and examining its contents, several pieces of broken pottery were found, the remains of dish or bowl, the edges or rims ornamented with small bead-like cubes of iron pyrites, inserted when the clay was soft and compressible. In general the exhibits were very clean, as though carefully washed, and there were present implements of black stone, the like of which I had never before seen, although there are a great variety of Micmac implements in the Halifax museum. They could scarcely be classed entirely as Micmac. Some thought they might be Milicete or Penobscot, or partly of a type more southern still. It was an interesting collection, very appropriate as a memento of the very recent age of stone in America, when man on this portion of the continent had made no progress beyond the rudest appliances to provide for his immediate wants.

It was intimated by direction of the President, that the delegates would meet next day at the Section of Natural Science, to present reports from the various affiliated Societies. Also, that the Governor-General and Princess Louise would hold a reception

of the Society in the Senate Chamber, at 1 p. m., and then the meeting adjourned.

Wednesday the Society again assembled, and reports were read by the delegates. These consisted for the most part of short papers, giving some account of the design and work of the several bodies. Mr. Allison, delegate from the Halifax Historical Society, made some pertinent verbal observations of its objects and progress, and spoke of the importance in connection with it, of preserving a particular record of the stirring events which had taken place in the early period of our provincial history. When called upon I was obliged to state that, owing to some misapprehension, for which I could not then satisfactorily account, I had no report. I had telegraphed to Halifax for the information I sought, in order to be ready for the occasion, but had not obtained it. I had previously prepared a Paper on the work of our Institute, which might be read as a report, which I then submitted for approval and handed to the Secretary. Shortly thereafter the Society adjourned to the Senate Chamber, and in about half an hour the Princess Louise arrived with the Governor-General and suite, who took their places around the throne. A French Canadian member of the Literary Section, with powerful voice and strong emphasis, delivered an original poem in the French language, "the poet's eye in a fine frenzy rolling." A number of presentations were then made, but a scarcely mannerly assemblage pressing before the Society and usurping its place, the Princess soon retired.

The sitting was resumed in the afternoon, when I was informed, through the Secretary of the Section, that the remaining time at their disposal was precious, and that it would be advisable to reduce the length of my paper, which he thought a very good one. This I immediately set about, and accomplished to his satisfaction. In the meantime a rather exciting geological discussion had taken place on a Paper read by Dr. Sterry Hunt. That gentleman contended that in the Thunder Bay section, or district, he had recognized a new geological formation, unconformable and of considerable thickness and extent, between the Huron and Laurentian strata—a statement stoutly opposed by

Dr. Selwyn, a gentleman intimately acquainted with the region, who said that it could not be—that there was not sufficient evidence for it, and that Dr. Hunt must be wrong. Both gentlemen were very positive in the views they entertained, which were supported by others of the meeting, and the discussion may be said to have been a drawn battle, to be decided by more positive evidence in the future. So far as I could ascertain of the views of members around, there appeared to be a rather general disinclination to the admission, under present data, of a new member of the geological series; and an opinion that Dr. Hunt and others may have mistaken for it an upper member of the Laurentian. On this afternoon the Governor-General paid a visit to the Section, and listened to an excellent Paper from Professor McCoun, on the plants of the North-West, with which His Excellency expressed his gratification, and soon after retired.

The President then gave notice that such papers as had not received attention might be read as reports on the following morning, which certainly included mine, and the Section adjourned.

Thursday was the Queen's Birthday. The weather, which for the three previous days had been an incessant rain, and very disagreeable, suddenly changed to clear and lovely sunshine, befitting the occasion. Bands of music paraded the streets at an early hour in the morning, and the day was celebrated as a public holiday. The Society, however, met as usual, eager to finish its business. Several reports from distant Societies had come to hand since the last adjournment, and it was decided that they should be read although out of time. This was hardly fair to my report, which was in no way objectionable, and should have had precedence. There could be no reasonable excuse, I thought, for the omission, although the report was that of a delegate. I therefore asked for its reading on the ground of the notice of the President at the adjournment last evening. But time was pressing. The prorogation of Parliament, the presentation to the Princess, and the Governor-General's Lunch at Rideau Hall, to which all were invited, were considerations far too important to be affected by minor details. Mr. Sandford Fleming and Prof.

MacGregor, both members of our Halifax Institute, recommended me not to press the reading. I acquiesced, and the meeting adjourned. I brought away my Paper, which, as I thought it fit to be read before the Royal Society, may not be an inappropriate Paper for the affiliated Nova Scotian Institute. I leave it with you. The Society met again in the afternoon when the celebrations had terminated. They elected Mr. Chaveau, a talented French Canadian gentleman, President for the ensuing year, and Dr. Sterry Hunt, an eminent geologist, Vice-President, and then the session of the Royal Society concluded its labours with the usual formalities.

It only remains to notice the gracious reception accorded to the members and delegates of the Royal Society by His Excellency the Governor-General and Her Royal Highness the Princess Louise, at Rideau Hall. The Society had been specially invited to a Lunch and Garden Party, on the anniversary of the birthday of Her Majesty Queen Victoria, mother of the Princess, and we need hardly say that the gracious invitation was generally accepted. The Presentation took place in the Hall set apart for the occasion. There were present Sir Charles Tupper and several members of the Government and of Parliament, and other distinguished persons. That funny fellow Mark Twain was there as a guest of His Excellency. Each member and delegate was introduced by Dr. Dawson, President of the Royal Society, and shook hands with the Governor-General and Her Royal Highness, both of whom looked in the best of health and in excellent good humor. The party were then ushered into the dining hall, which was soon filled with guests. His Excellency presided. An hour was spent in agreeable converse, and ample discussion of the viands and wines lavishly prepared for the occasion. Only two toasts were proposed. His Excellency gave The health of the Queen of England, which was quietly but enthusiastically responded to; then that of the President of the United States, which would have been responded to by Mark Twain, but was otherwise arranged. After the lunch the party visited His Excellency's Museum of curiosities, where were exhibited Zulu rifles, on one of which at least "the blood still stuck to the *stock*,"

spears, assegais, &c. A number of unique and valuable Indian curiosities were displayed, consisting of sumptuous Indian gala robes and dresses, spears, bows and arrows, collected in the North West during His Excellency's visit to that part of the Dominion. After deliberate inspection of these, His Excellency led the way to the Garden Party, of which the Princess did all the honors with the gracious affability she well knows how to assume. A cricket match in an adjoining field also drew the attention of the party, at the conclusion of which the festivities ended.

It would be premature to hazard a decided opinion on the permanence or otherwise of the Royal Society. Time must decide that question, which is an important one. The British Association pays a visit to Canada next year, and a good deal will depend on the action then taken. If the people of the Dominion can be induced, even comparatively, to take a similar interest in scientific pursuits to that which is manifested in England, there can be no doubt of the result. The Dominion Government, we dare say, will do its part upon the occasion. We fear, however, that neither numbers, nor wealth, nor inclination, nor time, can be sufficiently engaged to secure the immediate success of the Royal Society, although we earnestly hope it may be otherwise. There are some defects also in its organization, in that its numbers are unwisely limited. So far, however, the attempt is highly laudable, and ought to inspire the earnest zeal in its behalf of every lover of his country seeking its advancement among the nations.

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Glacial Distribution in Canada.

By the Rev. D. Honeyman, D.C.L., F.R.S.C., Hon. Memb.

1. *Triassic Amygdaloids (A) and Carboniferous Boulders.*—The author's investigations of glacial distribution in Canada began in 1873. On the beach at Cow Bay, east of Halifax Harbour, Nova Scotia, abundance of amygdaloid boulders were seen. These were at once referred to Cape Blomidon, whose rocks are Triassic basalts, amygdaloids, &c. Blomidon, or some part of its rock extension to Five Islands, N. E., and Brier Island, is the only series of rocks in Eastern Canada which could produce these boulders. Red Head, on the east side of Cow Bay, was seen to be the secondary source of the boulders. From this bluff of drift large and small amygdaloid boulders had just fallen. Here an agate was found, and specimens of Blomidon zeolites. Great masses of Cambrian quartzites had recently fallen, and were still imbedded in drift. These were strikingly grooved and striated on varying sides. Rock surfaces had also been observed on our way showing glaciation. Action and reaction were thus suggested. A copy of the Admiralty Chart, on which Blomidon and Halifax both appear, was procured. A very fine and extensive glaciated expanse of Cambrian argillites at Pleasant Park, Halifax Harbour, was located on this map. The direction of the glaciation and grooves, S. 20 E., N. 20 W., was extended, and found to pass in front of Blomidon. Deep grooves were seen having a south-east termination, where the graver had evidently been fractured by coming in contact with hard edges of tilted and crumpled strata, the grooves terminating in small *striæ*, running in different directions and disappearing. These show that the glaciating agency had evidently come from the N. W., the direction of Blomidon.

An interesting problem was thus presented for solution. I found similar boulders occurring in abundance on the Atlantic shore, from Point Pleasant, Halifax Harbour, west of Cow Bay, to Three Fathom Harbour, east of it. Associated with these were Lower Carboniferous Limestone boulders with fossils *(Brachiopoda, &c.,)* and boulders with Carboniferous plants, such as *Stigmaria, Lepidodendra,* and *Calamites,* from the beds intervening between Blomidon and the coast. This is very interesting, as showing that the transporting agency levied upon every formation over which it passed. An iceberg could not do this: a glacier could. The distance between Blomidon and Cow Bay is 62 miles. Drift accumulations and drift sections occurring on the lines of railway, especially the Windsor and Annapolis Railway, were all examined, and the amygdaloid boulders were found to increase in numbers as we approached their source.

2. *Triassic Amygdaloids (B).*—From a distance of 45 miles west of Blomidon, amygdaloids have also been transported to the Atlantic coast. In the drift cuttings of the Nictaux and Atlantic Railway, on the side of the Nictaux River, I found amygdaloids of the same character as those of Blomidon. I also observed a fine outcrop of Lower Silurian argillities on the north of Cleveland Mountain, on the south side of the Annapolis Valley. North Mountain, a continuation of the Blomidon range, is on the north side of the valley. The position of the glaciated rock-surface is at a height corresponding with the general elevation of North Mountain, 600 feet. This is the most northerly glacier found in Nova Scotia. The Triassic sandstones, which are undoubtedly in the valley, although they cannot be seen, must have filled the interval between the two mountain ranges in Pre-glacial times to account for the glaciation indicated and the passage of the amygdaloids. In my collection I have a large amygdaloid boulder which was picked up at Lunenburg, the Atlantic terminus. The Nictaux and Lahave Rivers, which nearly meet at their sources, are approximately in the line of transport, as are also a long chain of lakes. The Nictaux River flows northerly into the Annapolis River in the valley: the Lahave River, southerly, into the Atlantic. The Nictaux and Atlantic Railway runs generally in the same course.

3. *Archæan Gneisses, &c.* (*A.*)—On the north of Blomidon, at a distance of 13 miles, is the south side of the Archæan rocks of the Cobequid Mountains. This range extends from Cape Chignecto, on the Bay of Fundy, through Nova Scotia, to a distance of ninety miles. Boulders have been transported from it in a direction, indicated by glaciation, S. 20 E. mag., the same as the Blomidon amygdaloids. These are spread broadcast in the eastern part of Colchester County and the County of Hants, which bound Halifax County on the north. (*Vide* papers in the "Transactions of the Nova Scotian Institute of Natural Science," 1881–2 and 1882–3). In Halifax County they are largely intercepted by a great belt of granite, which is generally six miles wide, extending from Major's Lake, near Waverley Gold Mines, on the west, to Ship Harbour on the east. Some of the Cobequid boulders reach the shore along the course of the Musquodoboit River, and other breaks in the granite belt, *i. e.*, a granitic transportation takes the place of the other, the boulders of the latter having to be closely searched for among the abounding granite boulders at Musquodoboit Harbour and Clam Bay. At the Waverley (W.) end of the granites, or rather at the end of another granite occurring farther north, which seems to come into a line of it, the Cobequid boulders have found a better passage. Their course became changed to S. W., as is seen by the glaciation of the Cambrian argillites at the Intercolonial Railway, near the Grand Lake. This brings them into Bedford Basin, Halifax Harbour, and the City. The Archæan transportation thus unites with the Triassic, so as to predominate over the latter. The combined transportation then deposits the accumulations at Laurence Town, Cow Bay, and at Eastern Passage, Halifax Harbour, at Thrum Cap, McNab's Island, and George's Island in the Harbour, at Point Pleasant, Fort Massey, Fort George, Observatory Hill, H. M. Dockyard, and Fort Needham, and at Navy Island, Bedford Basin ('Trans.,' 1881–2.)

In like manner the great and extensive granites (B) on the west side of Halifax Harbour, in their extension toward Blomidon, at Bedford, intercept a part of the amygdaloids, and in turn are transported towards the Atlantic. Some of these boulders

become huge *roches perchés e.g.*, the great "Rocking Stone" of Spryfield.

3. *Archæan Gneisses, &c.* (*B*).—Eight miles from the north-east termination of Nova Scotia, near Cape St. George, Antigonish County, on the Northumberland Strait, is the "Typical Archæan Series," which I first recognized in 1866. Dana, in his 'Manual of Geology' (1674), gave it the name "Archæan," which I have since adopted. I found the boulders of the series, on the shore and in the drift, at Ogden's, Gypsum Bluff, St. George's Bay. The largest boulders on the shore are very striking in appearance. It is more than twenty years since I first noticed them. It was then supposed that they had been carried from the coast of Labrador. The identical rock was easily recognized among the series on the Northumberland Strait, associated with crystalline limestones and serpentines. There is no apparent glaciation, but a line drawn on the Admiralty chart from the rock *in situ* to the drift-section of St. George's Bay coincides exactly with the line of Blomidon transportation.

Fiords.—Looking at our chart, we observe that the Strait of Canso, which separates Nova Scotia and Cape Breton, and which enters St. George's Bay, runs parallel with our last Archæan transportation line. All the harbours of Nova Scotia, from the Strait of Canso to Ship Harbour, where the great granite belt ends, are approximately parallel. From Ship Harbour to Halifax Harbour, the harbours conform with the changed direction of transportation. Halifax Harbour, Bedford Basin, and the Estuary of the Avon are approximately in the line of the Blomidon amygdaloid transportation, and are only about eight miles apart.

Remarks.—The Archæan of Northumberland Strait lies (14') north of the Archæan of the Cobequids. The transportation could not originate there; we must, therefore, look beyond Nova Scotia. This consideration led me to refer to Logan's 'Geology of Canada,' (1863). Examining the Tables of Glaciation Grooves, I found that the S. E. courses to the N. E., N., and N. W. of Nova Scotia, prevailing over the S. W. in the proportion of two to one. The Nova Scotia transportation is, therefore, a contin-

uation of that of Quebec Province, and my investigations have given it an Atlantic terminus.

Ottawa Gneisses (*C.*)—On a visit to Ottawa, in May, 1882, I observed massive boulders of Archæan gneisses in a number of places. At the Rifle Ranges I examined them more particularly. Some of the gneisses were beautifully banded, others of them contained abundance of magnetite. In Sir W. Logan's table, the course of the glacial grooves at Rideau River, Stegman's Rapids, and also at Barrack Hill, is S. 45 E., true meridian. Defining this course on Vennor's Map, I found that a N. 45 W. extension passed between the Hull and Laycock Magnetite Iron Mines. According to the same table, at Hull the glacial grooves run S. 45 E. This is certainly a satisfactory coincidence.

Kingston Gneisses (*D*) *Archæan.*—When I was at the Dominion Exhibition at Kingston, in September, 1882, my attention was directed to the large quantity of boulders which lay about the exhibition grounds. The greater part of them corresponded with the Ottawa boulders, with the exception of the magnetic ones, and were consequently Archæan. One boulder was of Trenton Limestone, and was glaciated. Looking for glaciation *in situ*, I found it on the limestones at the edge of the water near the entrance to the Royal Military College. The course of the grooves was S. 54 W. magnetic. The direction observed by Sir W. E. Logan was S. 45 W., true meridian, while "other grooves run S. 85 E." Trenton Limestone is the formation on which Kingston is built, and of which it is built. Hence it is called "the Limestone City." In the approach to it, near the Rideau Canal, the Archæan (Laurentian) is seen with the Trenton Limestone lying directly upon it, in the same way as on the Railway from Montreal to Ottawa, near the latter. We have now reached long. 76° 25' to 29', and lat. 44° 14' to 19'. In long. 80° 54', lat. 44° 28', is the last of the south-easterly grooves (S. 5 E.), according to Logan. In long. 79° 33', lat. 46° 10', is Nipissing Lake. Here, and beyond all grooves are, therefore, S. W. Lake Temiscamang, long. 79° 26' to 30', lat. 47° 7' to 36', has glaciation generally S. E. This is the region of divergence as well as of watershed.

Rimouski Gneisses (*E*) *Archæan*—At the Railway Station on both sides of the railway, I found and examined Archæan boulders of large size. Some of these were granitic gneisses identical with those that I found at Ottawa and Kingston. The only place where the rocks of this kind are to be found *in situ* near Rimouski is on the opposite side of the River St. Laurence, which is here 20 miles wide. Glaciation was found by Sir W. E. Logan at Kempt Road, near Metapedia Lake, long. 67° 43', lat. 48°. Its course was S. 80 E.

I would observe that the lines of glaciation of Pleasant Park, Halifax, extended in a northerly direction on our Admiralty chart, pass through Rimouski at a distance of 310 miles.

Our field of observation thus extends from Cape George, Nova Scotia, long. 62°' to Kingston, Canada, long. 76° 25' to 29', *i.e.* through 14° 25' long., and from Halifax, lat. 44° 34', to Rimouski, lat. 46° 26', *i.e* through 3° 52' lat.

NOVA SCOTIAN INSTITUTE OF NATURAL SCIENCE, HALIFAX, NOVA SCOTIA.

PATRON—His Honor The LIEUTENANT-GOVERNOR.

COUNCIL, 1883-4.

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The Anniversary Meeting of the Institute is held on the *second Wednesday* in October in every year.

The Monthly Ordinary Meetings of the Institute, when papers are read, are held on the second Monday evening in every month, commencing in November and ending in May.